EMAX II

Technical Manual

E-mu Systems Inc.
Applied Magic for the Arts

Emax II
16-Bit Digital Sound System
Technical Manual
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Written by Riley Smith
Basic Instructions by Craig Anderton
Emax II Test Disk by Theo Byassee
Assembly Drawings by Ron Poffenbarger

■ FI376 Rev. A

E-mu Systems, Inc.
1600 Green Hills Road
Scotts Valley, CA 95066
(408) 438-1921

Important Notice: In order to to obtain warranty service on an Emax II, the serial number sticker must be intact and the customer must have a sales receipt or other proof of purchase. If there is no serial number sticker on an Emax II, please contact E-mu Systems at once.

This product is covered by one or more of the following U.S. patents: 3,969,682; 3,986,423; 4,404,529; 4,506,579; 4,699,038; and foreign patents and/or pending patents.
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INTRODUCTION

The Emax II 16-Bit Digital Sound System is a product that makes extensive use of VLSI technology. This has several benefits, including: increased performance, increased reliability and reduced cost to the consumer.

Emax II's with surface mounted chip problems should be either returned to the factory for repair or have the entire board swapped. Do not attempt to remove surface mounted devices yourself or serious damage to the circuit board may occur (which will not be covered under warranty).

To service the Emax II, you should be familiar with digital logic, DAC's, op-amps as well as microprocessor troubleshooting techniques. The minimum equipment required to service and repair the Emax II is: a digital multimeter, a 100MHz dual trace oscilloscope and basic technician hand tools.

The information contained in this manual is proprietary to E-mu Systems Inc. The entire manual is protected under copyright and none of it may be reproduced by any means without written permission from E-mu. Please consider all of the data in this manual proprietary and use it only to service the Emax II.

We feel obliged to remind you that any modification of the Emax II other than as specified by a factory authorized E-mu Change Order (ECO) will void the warranty of the instrument.

Please read this manual thoroughly before attempting to service the Emax II. The basic instructions provided in chapter one will familiarize you with the basic operation of the unit and help you determine if the problem is due to user error. We also encourage you to obtain a copy of the Emax II Operation Manual in order to become even more familiar with the unit.

If you feel unsure about working on the instrument, please feel free to contact our Service Department at (408) 438-1921 between the hours of 9:00 - 5:00 PST, Monday through Friday.

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BASIC OPERATION

INSTANT GRATIFICATION

INSTANT GRATIFICATION!

If you just can't wait another second before hearing the Emax II, we understand. Follow the directions below EXACTLY as given and get ready to hear some great sounds. (Incidentally, in case you make a mistake or run into problems, don't worry. This process is described in greater detail later.)

1. With the Emax II unplugged, patch the rear panel Right & Left, or Right Mono jack to the input of a high quality amplification system. You can also plug stereo headphones directly into the headphone jack.

2. Check that the rear panel voltage selector is set for the correct voltage in your part of the world.

3. Plug the Emax II line cord into an AC outlet.

4. Check that no disk is currently in the drive. If so, or if the disk drive contains cardboard packing materials, push in on the disk eject button towards the bottom of the drive, remove the disks or packing materials, and put them in a safe place.

5. Turn on power; Emax II will do a drive check for a few seconds, then the display will say "Please Insert Disk" if you do not have a hard disk or "Checking SCSI 1, then Booting from SCSI 1" if you *do* have a built-in hard disk.

If you don't have a hard disk, insert one of the diskettes that came with your Emax II into the disk drive. The Emax II will begin loading software from the disk you have placed in the drive.

SELECT DRIVE

6. Press the button labeled **DRIVE SELECT** on the front panel of Emax II. Use the data slider to select "SCSI 0: Floppy", if you want to load a floppy disk; or "SCSI 1 Conner", if you have a built-in hard disk drive. Then, press **ENTER**.

LOAD FROM FLOPPY DISK

7a. Press the **LOAD BANK** button, then simply insert a floppy disk and press **ENTER**.

LOAD FROM HARD DISK

7b. Press the **LOAD BANK** button, then select one of the sound banks using the data slider. When you find one that strikes your fancy, press **ENTER**.

8. Raise the volume slider to the up position.

9. The display will show the name of the Current Preset (we'll talk more about the Current Preset concept later). Turn up the volume control and start playing the keyboard. All right!! The display will show you the ID number (P followed by two digits) and name of the sound you are playing. These sounds are called presets, for reasons which will become clear later.

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INSTANT GRATIFICATION

10. Use the telephone-type numeric keypad underneath the display to call up different presets. Press a two-digit number; start with 01 and play the keyboard for awhile, then press 02 and play, 03, 04, etc. At some point you will run out of factory presets, and the display will say "Empty Preset."

If you want, vary the control wheels towards the left hand side of the keyboard. They may not be active with some presets, as they perform different functions with different presets.

To load another floppy disk, press **LOAD BANK**, and the display will say:

```
Load All Presets
And Sequences
```

Insert another floppy disk, then press **ENTER**. Emax II will begin loading the new bank.

Note: Some Emax II banks require two or more floppy diskettes. In this case, simply insert the diskettes in sequential order (1, 2, 3...).

To try out presets from other factory hard disk banks, locate the **LOAD BANK** button (in the group of four buttons to the right of the numeric keypad) and press it. Use the data slider to scroll through the available hard disk banks. When you find a bank that interests you, press the flashing **ENTER** button right below it. The disk drive will start making noises, and a few seconds later you will have loaded another bunch of sounds into the Emax II.

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CONNECTION INSTRUCTIONS

CONNECTION TO A MIXER

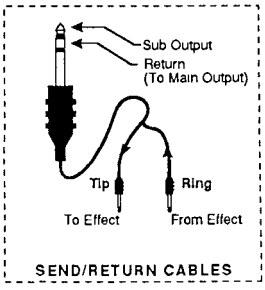
■ **STEREO:** Emax II has provisions for a variety of output connection schemes. The most common hookup will probably be for stereo operation. Connect the left and right audio out phone jacks to the inputs of your mixer or stereo preamp. Emax II will also drive stereo headphones, which can be plugged directly into the headphone output. For maximum dynamic range, keep the front panel volume control turned up full.

■ **MONO:** If a monophonic amplifier is used, simply connect the right/mono output to the input of the amplifier. Guitar amps are not recommended because they are generally noisy and low fidelity. The output level of the Emax II is somewhere between instrument and line level. Care should be taken when connecting to an instument amplifier so that the delicate nerve cells in your ears are not damaged.

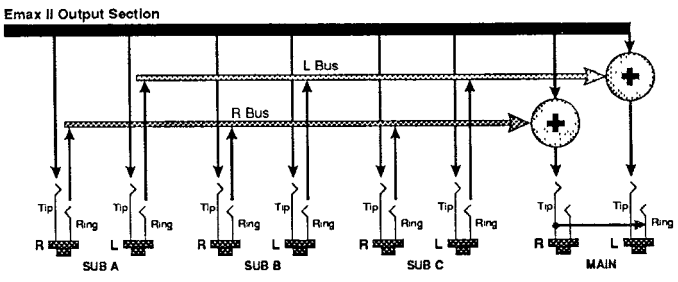
■ **SUBMIX OUTPUTS:** There may be times when different equalization or reverb settings are desired on the various instruments that have been sampled. Emax II has eight polyphonic outputs that can be used when individual processing on specific instruments is desired. Any combination of voices can be programmed to appear at any channel output. Voices are assigned to output channels using the Edit Assignment function in the Preset Definition module or in the Keyboard Mode function of the Dynamic Processing module. Each of the Sub A, Sub B, and Sub C outputs on Emax II are stereo jacks. The tip of each jack (accessed when a standard phone plug is inserted) connects to the right or left output of the group. If a stereo plug is inserted, the Ring of the stereo plug serves as a signal return, which sums into the Main outputs.

Therefore, the Sub A, B, C jacks can serve as effect sends and returns in order to further process selected voices and then return them to the main mix.

The submix send/return jacks can be used to process selected voices and return them to the main mix instead of using the effects bus on your mixing board. In a pinch, the effects returns could also be used to sum additional instruments into the main outputs of the Emax II.



This diagram shows the type of cable used to access the Emax II submix sends and returns.



This diagram shows how the stereo jacks are used to function as effect sends and returns.

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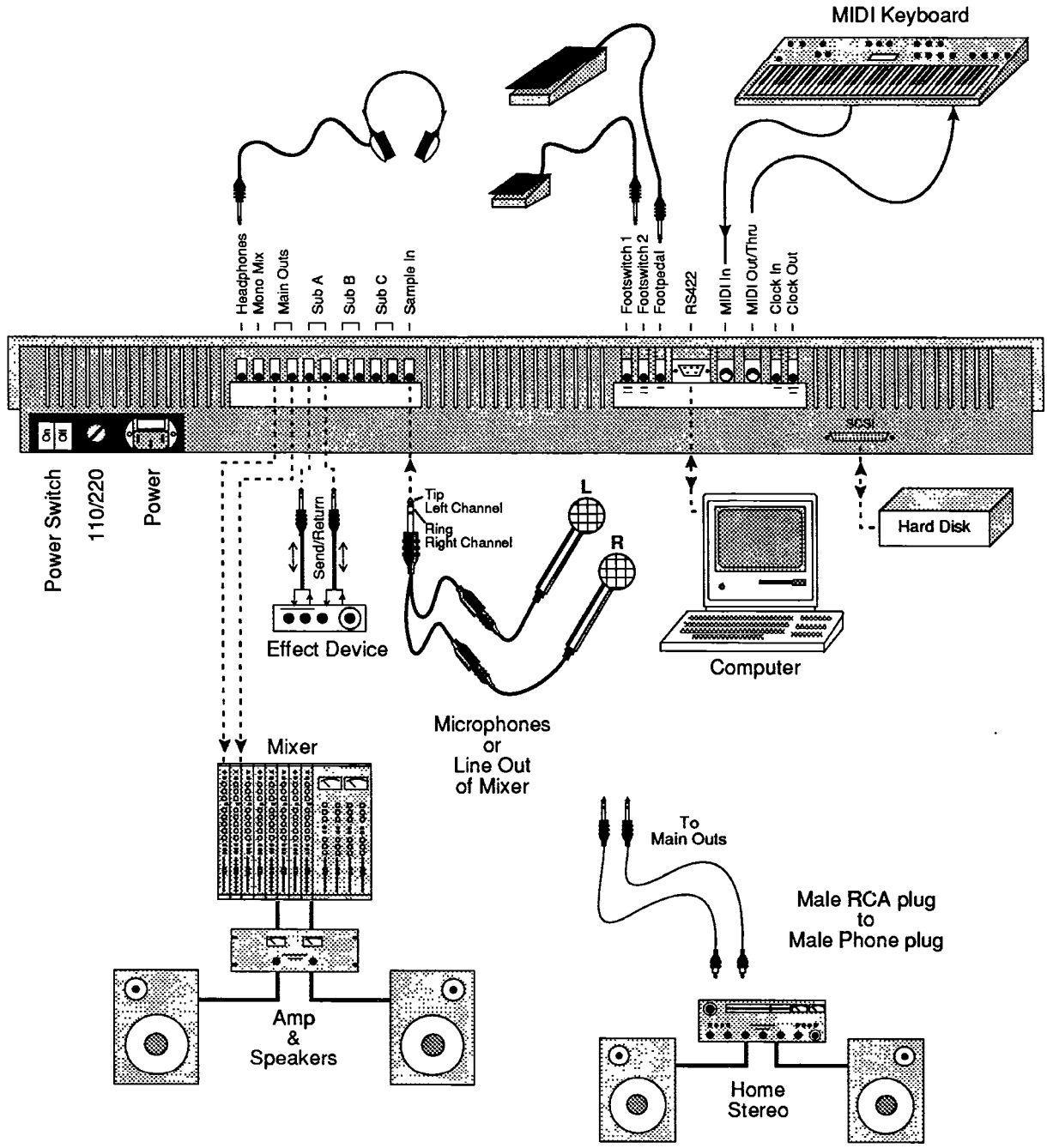
CONNECTION DIAGRAM



This diagram shows how various pieces of equipment can be interfaced with the Emax II. The connections to the Emax II rack are identical.

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CONNECTION INSTRUCTIONS

SAMPLE IN CONNECTION

The Sample In jack can accept any signal level from microphone level to line level. The gain is adjusted with the data slider while in VU/gain mode in the sample module. The level can be read in the liquid crystal display while in this mode.

If your Emax II contains the stereo sampling option, use a stereo plug in the Sample In jack to sample in stereo. The **Tip** of the stereo plug corresponds to the **Left** channel and the Ring of the plug corresponds to the **Right** channel.

MIDI CONNECTION

Emax II provides a MIDI In and a MIDI Out/Thru port.

■ The MIDI In port on the Emax II is connected to the MIDI Out port of an external MIDI controller which could be a keyboard, a sequencer, MIDI drum kit or whatever.

■ MIDI Out can be connected to another MIDI instrument or sequencer. In MIDI Thru mode, MIDI Out will re-transmit any MIDI information that appears at the MIDI In port. In MIDI Out mode, only information from the Emax II's keyboard, sequencer or realtime controls will be transmitted, except when overflow mode is selected. Overflow mode allows a second Emax II to be connected to the MIDI Out to allow 32 channel operation.

FOOTSWITCH AND PEDAL CONNECTION

■ Two control footswitch jacks are provided for performance control of sequencer, arpeggiator, sustain, release, X-switch, and preset advance. The footswitches need not be connected for the unit to operate but they offer exciting control possibilities. The footswitches should be of the momentary contact type, but can be **either normally-open or normally-closed.**

■ The control pedal is used as a realtime control in the same manner as the wheels. It can be programmably routed to a destination by using the realtime control section of the preset definition module. The pedal can either be a voltage type, (which outputs a DC voltage from 0-9 volts at the tip of the jack) or a resistance type (which varies a 10K ohm resistance from the tip to ground of the jack). Both the footswitches and the pedal are available from your dealer.

CLOCK IN CONNECTION

The Clock In jack allows a non-MIDI external device such as a drum machine or sequencer to control the tempo of the sequencer or arpeggiator. Emax II can receive input clock rates of 24, 48, or 96 pulses-per-quarter note. **The pulses should be at least 1 millisecond wide and have a level of 1 to 5 volts.**

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CONNECTION INSTRUCTIONS

CLOCK OUT CONNECTION

The Clock Out jack allows the Emax II to be the master clock and drive non-MIDI sequencers and drum machines at a rate of 24 pulses-per-quarter note. This is a **5 volt pulse which is about 6 milliseconds wide.**

SCSI CONNECTION

The 25-pin connector on the rear of your Emax II is a SCSI port (pronounced scuzzy), which stands for Small Computer Systems Interface. SCSI is an ultra high-speed parallel port, normally used to connect external hard disk drives. Up to 7 external devices can be connected the the SCSI port. Each device on the SCSI bus must have its own unique ID number so that Emax II can distinguish it from the other devices. If you have an internal hard disk, it will be assigned ID #1. The floppy drive is assigned ID #0. If there are two devices on the SCSI bus with the same ID number, a SCSI error will result. Consult the operation manual of your external storage device for information on changing the ID number.

- Always use quality SCSI cables which are as short as practical (total length <12 ft).
- Tighten the thumbscrews on the jacks to ensure good electrical connection.
- Power up external SCSI devices *before* the Emax II.
- All SCSI devices on the bus ***must*** be turned on.

RS-422 CONNECTION

The RS-422 connector is a high-speed *serial* communication port which allows data to be transferred to and from an external computer at a high rate (500K baud). The connection cable to the external computer will generally be supplied with a software package (such as Sound Designer by Digidesign) and will not usually be available from your music dealer.

110V/220 V SELECTOR

The 110V/220V selector allows the Emax II to be used in either 110 volt or 220 volt environments at either 50 Hz or 60 Hz. In the USA ,110 volts is the standard. To change the voltage setting, first UNPLUG the unit; then use a flat blade screwdriver to change the setting. ***WARNING:*** Operating Emax II at the wrong setting may seriously damage the unit.

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EMAX II BASICS

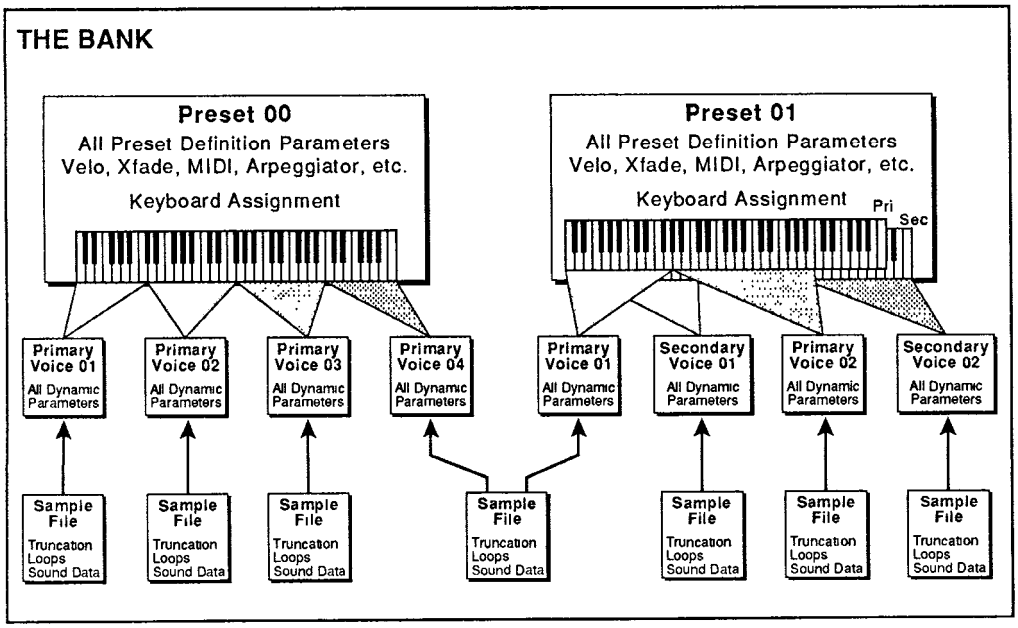
HOW EMAX II ORGANIZES SOUND

READ THIS SECTION CAREFULLY OR THE REST OF THE MANUAL WILL NOT MAKE SENSE!!

Throughout this manual we will use the terms and concepts described and defined below. Read through this section carefully, even if you don't retain it all, and refer to this section periodically as you read the manual until you know the meaning of all the following definitions.

THE BANK

The bank contains all of Emax II's memory, which includes preset, voice, sample and sequence data. **Consider the bank as the central storehouse for all of Emax II's data.** Although the memory is *volatile*, meaning that the data disappears when you turn off power or load a new bank, the bank data can be saved permanently on disk to keep a record of your work. Since we now have a place to store information temporarily (the bank), and two ways to store information permanently (saving to disk), let's take a look at the different kinds of information being stored.



*An Emax II bank is **all** the data currently loaded into its memory.*
Each preset has its own set of voices which may share sample data with other voices.

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EMAX II BASICS

SAMPLES and VOICES

Sampling a sound (drum sound, oboe, zither, hamster sneeze or whatever) using the instrument's "Recording Studio" capabilities creates a *Sample*, the "raw material" with which the instrument works. The total available sampling time can be divided up any way you like—one long sample, lots of short samples, a few medium samples, or any combination thereof. Note that a "sample" is a digital recording of a complete sound, or each "snapshot" of the sound that makes up the recording.

You may process this raw sample via filtering, truncation and so on to create a *Voice*. Individual voices can be saved to disk and loaded from disk as part of a *Preset*. The preset can store up to two voices per key, each identified by a two-digit voice number and the voice's original pitch.

MAKING A "PRESET"

A voice can be assigned to a single note on the keyboard, or transposed polyphonically to cover a wider range of the keyboard. The process of assigning, and optionally transposing, voices to specific ranges of the keyboard is called *Making a Preset*. (Note: It is often necessary to use multiple voices to make up a preset, since wide-range transposition alters the voice's timbre. Therefore, using multiple samples and transposing each over a small range usually gives the most realistic sound). Individual presets, including their voices and samples, can be loaded from disk.
Making a preset is a three-step process:

1. Create the preset and give it a number and name. The bank can hold up to 100 presets.

2. Assign voices to different ranges of the keyboard (for example, with five voices you could assign each voice to cover one octave of the keyboard). Note that the same sample can be assigned to more than one range of the keyboard in a given preset. Also, that sample can be assigned to more than one preset.

3. Choose from a number of options that further define the preset, such as assigning voices to partially or fully overlap other voices (thus producing doubling effects), assigning dynamic control to individual voices in a preset, erasing presets you don't like, cataloguing presets, adding arpeggiation, setting up MIDI parameters, etc.

THE CURRENT PRESET

When you load a sound disk, a preset will be ready to play and the display will show the preset number. This is the *Current Preset*. If you select another preset, or create a preset, it will become the current preset.

THE CURRENT VOICE

Voices contained in a preset can be sent to the Dynamic and Digital Processing modules for further alteration. However, since a preset typically contains several voices, we need to specify which voice, or voices, we want to process.

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This is called *Selecting the Current Voice,* another three-step process.

1. Call up a preset that contains the voice(s) to be processed.

2. Select the range of the keyboard to be processed. This will automatically select the voice, or voices, that fall within the specified range (a group of voices being processed simultaneously is still referred to as the "current voice").

3. You may send the current voice through the Dynamic and Digital Processing modules, whereupon they return back to the bank in their modified form.

MORE ABOUT VOICES: THE PRIMARY AND SECONDARY VOICE

An Emax II key can contain up to two "channels." These two channels contain the *Primary and Secondary* voices. For example, the primary voice might be a guitar note, and the secondary voice a detuned version of the same guitar note. When they are played together, you hear chorusing. Also, a preset contains information about how the keyboard dynamics affect the primary and secondary voices. For example, the primary voice could be that of a drum hit played softly, and the secondary of a drum hit played loudly. You could then set up the keyboard so that playing the keyboard softly plays the primary voice, and playing the keyboard more forcefully plays the secondary voice.

■ *On an Emax II with the Stereo Sampling option, the Left channel will correspond to the Primary Voice and the Right channel will correspond to the Secondary Voice.*

MODULE

A *Module* controls a particular section of the Emax II. There are six main modules (see the labels to the right of the 12 main pushbuttons) and a sequencer module that has six sub-modules (see the labels to the left of the 12 main pushbuttons).

FUNCTION

Each module contains individual numbered *Functions.* Example: function 2 in the **MASTER** module checks the amount of memory remaining.

ACTIVATING A MODULE

To work with a module, you must first *activate* it. Press the button associated with the desired module. The display will then show the *Module Identifier.*

THE MODULE IDENTIFIER

When you activate a module, the display identifies which module you have activated, and how many functions are available.

There are two ways to select a function within the module. Those just getting started can move the data slider until the display shows the desired function, then press **ENTER**. As you work with the Emax II, though, you will start to memorize the function numbers and will probably find it faster to simply key in the appropriate function number using the numeric keypad.

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EMAX II BASICS

THE DISK ARCHIVES

So far, we've loaded a bunch of voices into the bank, created some presets containing those voices, and done some voice processing. However, ***remember that the bank only retains this information for as long as the Emax II is plugged in and turned on.*** Of course, we don't expect you to leave the thing on all the time, which brings us to the subject of saving data on disks.

Commanding the central computer to "Save All 16-bit" (**PRESET MANAGEMENT 8**) shuttles all the bank data (voices, presets, and sequences) to disk. This disk permanently (well, at least as long as the disk lasts) stores data so that even after turning off the Emax II, the disk will contain a record of your work.

■ Emax II also allows you to save your work in an Emax I format. This process uses a data compression process to squeeze more data onto a disk. A 1 megabyte Emax II bank, when compressed, may be stored on a single floppy disk. In many cases the compressed data will be audibly indistinguishable from the 16-bit version.

IF YOU DO NOT DO A "SAVE ALL", ALL BANK DATA WILL BE LOST WHEN YOU TURN OFF EMAX II.

Do not wait until the end of a session to save—save your work (**PRESET MANAGEMENT 8**) periodically in case of power failure or some other unforeseen circumstance which might erase the bank's memory.

Since the disk (hard disk or floppy) contains a record of the bank data, loading the disk back into the bank transfers all the voice, preset, and sequencer data into the bank (this will replace the existing bank data, if any). Therefore, you can work a bank of sounds out at leisure, and save the results of your work on disk; when you go to a gig, simply load all your hard work from disk into the Emax II in a few seconds.

THE BIG RE-CAP

One more time: A *Sample* is a raw sound, that upon being recorded into the *Bank* immediately becomes a *Voice.*

To create a new *Preset,* make sure you have all the voices required for the preset in the bank, number and name a preset, then assign combinations of voices from the bank to specific sections of the keyboard. By specifying one or more of these voices as the *Current Voice,* the current voice may then be processed by Emax II's dynamic and digital signal processors.

Since loading in a disk fills the bank with voices and presets, you can group these voices into new presets, process the voices or alter the existing presets.

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GUIDED TOURS

GUIDED TOUR #1:
MEET THE EMAX II

Welcome to the Guided Tours! If you have just met Emax II for the first time, follow these tours until you complete the Guided Tours section. This will get you "up and running" on the Emax II in the fastest possible time. Also, you'll learn some tricks in this section that will come in handy as you play some more with the Emax II.

This tour covers how to...

- Get ready for the tours
- Load a bank from the hard disk
- Select different presets within the bank
- Load a floppy disk
- Tune the Emax II to other instruments
- Transpose the keyboard

...and also discusses Emax II's "modular" design philosophy.

HOW TO USE THE GUIDED TOURS

Please follow all steps exactly as given. For example, if we ask you to load the Arco Strings disk, even if you would really rather hear something else load in the strings—several sections of the tour will refer to specific sounds on that disk.

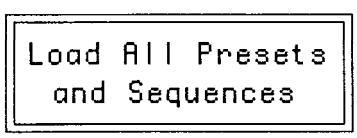
Occasionally during a tour you will be told to refer to something like **PRESET DEFINITION 4, SAMPLE 2,** or some other name. This means that you will find more information in the specified section of the Emax II Operation Manual. It is highly recommended that you have a complete Emax II Operation Manual in your shop for reference purposes.

LOADING FLOPPY DISKS

So far, so good...now it's time to move on.

1. Press the button labeled **DRIVE SELECT** and use the data slider to select, SCSI 0: Floppy.
2. Select the Arco Strings disk (4 M Emax IIs- Piano & Strings), and insert it in the drive.

3. Press the button labeled **LOAD BANK.** The display will say:



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GUIDED TOURS

4. Press **ENTER** to load the floppy disk. Remember that loading in a new bank will erase the currently loaded bank, so always think twice before pressing Enter to load the bank.

5. Play the sounds from the newly-loaded disk, then move on to the next section.

LOADING A BANK FROM THE HARD DISK

If you are using an external hard disk, make sure that it is correctly connected (Connection Instructions) and formatted (**MASTER 5**) for the Emax II.

1. Press the button labeled **DRIVE SELECT** and use the data slider to locate the hard disk. Hard disk drives may use SCSI ID numbers 1-7.

2. Press the **LOAD BANK** button; the display says: Load Bank, and shows the name and number of the current bank. Use the data slider to scroll through the available hard disk banks. Stop when you find the bank labeled Arco Strings (4 M Emax IIs- Piano & Strings), then press **ENTER**.

■ An alternate method of loading a hard disk bank is to press **LOAD BANK**, then simply type in the number of the bank using the numeric keypad.

■ *The Emax II will not boot up unless all devices on the SCSI bus are turned on.*

The display will show the current preset number and name (the cursor will flash underneath the first digit). Start playing the keyboard and adjust the Volume slider for a comfortable listening level.

SELECTING DIFFERENT PRESETS

1. The bank you just loaded contains several presets. To call up a new current preset, use the keypad underneath the display. Note that "leading zeroes" must be entered for preset numbers (i.e. type 0 and 0, not just 0, to call up preset 00). Now type 0 then 0 on the keypad; these will replace the numbers indicated by the flashing cursor.

2. The display says P00. Play the keyboard... hey, check out those sounds!

3. Now call up more presets (refer to **GENERAL INSTRUCTIONS 1**, "Selecting the Current Preset,"). If you enter a number for which there is no preset, the display will list the entered preset number and say "Empty Preset"; try again.
4. To scroll through the presets available in the bank, move the data slider. The various preset names will scroll on the lower display line. When this line shows the desired preset, press **ENTER** to make that the current preset. This is an alternative preset selection method.

5. Increment or decrement the current preset (as displayed in the top line) with the **CURSOR** buttons. This method is useful for live performance—arrange your presets in the desired order, and step through them as needed.

When you're ready to check out some more sounds, proceed.

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GUIDED TOURS

THE EMAX II "MODULAR" SYSTEM

The left side of the Emax II front panel includes the volume, data slider, **ON/YES** and **OFF/NO** (Increment and Decrement) buttons, the Liquid Crystal Display, two cursor control buttons, and a numeric keypad. Once you select a module and function, this area is where you will specify parameters.

The *modules* start towards the right of the keypad. Each module will be discussed in detail later on; the following is intended mostly as background information. Each module affects a certain area of Emax II's operation.

■ **Function Buttons** These are the buttons that get you going. Load Bank and Enter load disk data into the Emax II, Drive Select selects which disk drive will be used, and Transpose, as you probably suspect, transposes the keyboard.

■ **Sequencer** This module is a 16-track solid state control data recorder. While optimized for downloading MIDI data from other sequencers, it has some very useful features such as Mono operation when driven via MIDI, ability to re-assign presets, track bounce, and so on. It consists of the Sequencer Setup module (which sets up a sequence for recording) and the Sequencer Manage module (which lets you load, erase, copy, and do other sequence "housekeeping"). All sequencer functions are controlled by the left-hand column of buttons.

■ **Master** This module contains functions that affect the overall keyboard or bank (memory remaining, keyboard velocity curve, master tune, erase all and format disk). This also contains the Special commands.

■ **Sample** This "recording studio" module records sounds from the outside world into the bank. Features include adjustable preamp gain, variable threshold setting, and adjustable sample rate and length.

■ **Digital Processing** With this powerful module, you may edit a voice's length, loop (i.e. infinitely sustain) any portion of the voice (with several different looping options), have Emax II automatically find the best loop points ("Autoloop"), splice two different voices together, mix two voices, amplify or attentuate the voice, and more.

■ **Preset Management** This module handles the preset "housekeeping"—load presets from disk, save presets to disk, create, copy, rename, or erase presets, and check on how much memory space a preset uses up.

■ **Preset Definition** This module lets you change parameters within a given preset. Set up the arpeggiator or MIDI options, assign the pitch bend and modulation wheels to control various parameters in real time, copy or erase voices, edit the voice assignment, choose Stereo Voice mode, and set some keyboard parameters (dynamics and crossfade between overlapping voices).

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GUIDED TOURS

■ **Dynamic Processing** This module sets parameters that should be familiar to those who have worked with analog synthesizers. Set the dynamics by adjusting the VCA envelope, control timbre using the VCF (filter) and its associated AHDSR envelope generator, modulate the signal with the LFO, tie the keyboard velocity to various parameters, set the tuning, attenuation, and delay for each voice, and more.

Remember—if you want to save modified voices or presets, save the altered bank to disk. Otherwise, any changes will be lost as soon as power to the Emax II is interrupted.

ACTIVATING A MODULE, SELECTING FUNCTIONS, DE-ACTIVATING A MODULE

Here's important background information on how to access the various module functions. As the tours progress, we'll relate this information to practical examples.

■ **Activating** Each module has an associated switch. Most of these are found in the right-most series of blue buttons, however, the Sequencer Setup and Sequencer Manage module buttons are found in the green column of Sequencer-related buttons. Pushing the associated switch "activates" the module, as indicated by an LED next to the switch lighting up. Upon activation, the display's top line will show the Module Identifier (such as "Master," "Preset Management," etc.). In some cases, upon activation the display will ask you to specify the current voice (as described in the next Guided Tour). Once the module is active, it's time to start...

■ **Selecting functions** Each module includes a printed list of functions on the front panel; these functions are available when the module is active. Selecting a module function requires keying in its associated number with the keypad. We will shortly give an example of how this all works.

■ **De-activating** When you're finished with the module, either press its button again to de-activate, or simply activate a new module.

TUNING THE EMAX II TO OTHER INSTRUMENTS

Refer to **MASTER 1**. This function demonstrates how Emax II uses the data slider to adjust a parameter (in this case, overall tuning).

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GUIDED TOURS

GUIDED TOUR #2:
SPECIFYING THE "CURRENT VOICE"

BACKGROUND

Emax II has two modules dedicated exclusively to processing voices within a preset: **DIGITAL PROCESSING** and **DYNAMIC PROCESSING**. *Each voice* stored in a bank can be processed independently (or groups of voices may be processed simultaneously if desired). Therefore, we need a way to specify the *Current Voice*, which is the individual voice (or collection of individual voices) to be processed.

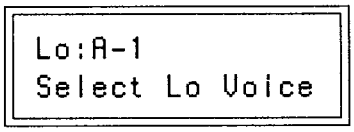
The concept of the *Current Voice* is important. To process one voice out of a preset, assign the current voice to be that one voice, and process it. To process more than one voice at a time, specify a group of voices to be the current voice and process all voices simultaneously.

This section covers how to identify which keyboard keys belong to which voice, and how to specify which voices or voices make up the current voice. For a short form version of this tour, see **DYNAMIC PROCESSING 00** and **DIGITAL PROCESSING 0**.

Begin this tour by loading Arco Strings (Piano & Strings) into the bank. Also, read the section **FUNCTION, ENTER DATA** as the **ENTER** button will be used frequently during this and most subsequent tours.

IDENTIFYING WHICH KEYBOARD KEYS BELONG TO WHICH VOICE

1. Once the Arco Strings (Piano & Strings) bank is loaded, the display should show 00 as the current preset. Select preset #10 - Demo Strings, then activate the Dynamic Processing module. Its LED will light after a second. If a current voice has not been previously selected (it shouldn't have if you just loaded in the disk), the display will say:



If this is the case, move on to step 2. If a current voice has been previously assigned, the display's top line will give the module identifier. If this is the case, before proceeding to step 2 initiate the **CHANGE CURRENT VOICE** function by keying in **00.**

Note: that if the preset contains primary and secondary voices, the display will ask whether you want to process the primary, secondary, or both voices (**GENERAL INSTRUCTIONS 2**). With this preset, however, there are only primary voices. Emax II is a smart little critter, so it won't ask you to select between primary and secondary voices unless both types of voices are present.

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GUIDED TOURS

2. Play the keyboard, starting at the lowest note. The upper display line will show the note you're playing, while the lower display line will show the voice number and its original pitch (in this case, 01 and F#0). The original pitch is the pitch of the sample itself.

```
Lo:A-1
Pri:01 Orig:F#0
```

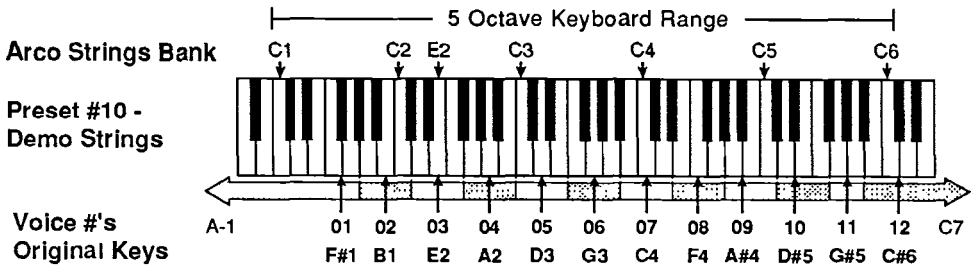
This lower display line remains as is until you play the first A. From this, we can conclude that voice 01's original pitch is F#0, and that it was transposed to cover the range from A-1 to G#0.

If there were both primary and secondary voices present, the display might look something like this:

■ *The data slider may also be used to quickly find all the voices assigned to the keyboard.*

```
Lo:A-1
P:01 F#0 S:05 F0
```

Play ascending keys, one at a time, over the full range of the keyboard. The display will give the voice number and the original pitch. Take a minute or two and note where the various voices begin and end, and which voices are at which locations on the keyboard. They should be as follows, with the original keys indicated by the numbered arrows:



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GUIDED TOURS

SPECIFYING THE DYNAMIC PROCESSING MODULE CURRENT VOICE

Now that we know how many voices there are in the preset, and the range covered by each voice, let's specify a range of voices to be altered by the Dynamic Processing module, starting with the lowest voice. This will become the lowest part of the current voice.

1. Press a key in the lowest voice of the range you want to process. For this exercise, press E2. When the upper display line confirms your choice, press **ENTER**. Since E2 is located within voice 03, that voice becomes the lowest voice of the current voice. Note that you could have pressed any key within voice 03 to specify that voice.

2. The display now shows the highest note of the voice in which E2 resides. Don't press **ENTER** yet—but if you did, this highest note would set the upper limit of the current voice. Instead, let's make the current voice cover a somewhat wider range. Press C4 (the display will show this as the new high note) and press **ENTER**. As with selecting the lowest voice, selecting any key within the highest voice makes that voice the upper range of the current voice. Thus, the current voice now extends from V03 to V07, and covers the range from D2 to D4.

3. You will now see the module identifier, which means you're ready to start modifying the sounds in the bank with the Dynamic Processing module, the subject of the next tour.

4. The assigned current voice will remain as is until you either change the current voice assignment, change presets, or load another bank. If you switch between modules, the current voice remains as assigned (unless you select the Digital Processing module, which will be a subject of a later tour).

5. Before proceeding, look over **DYNAMIC PROCESSING 00** to help reinforce what you've learned. Now that you know what a current voice is and how to specify it, we've reached the end of this tour (although you may need to come back from time to time to refresh your memory). In the next tour, we'll see how to modify voices with the Dynamic Processing section.

GUIDED TOUR #3:
DYNAMIC PROCESSING OF A VOICE

BACKGROUND

The Dynamic Processing module consists of several sound processing functions. Let's start with the Filter and VCA sections, as they are among the most important.

Make sure you have loaded in the Arco Strings (Piano & Strings) bank and selected the current voice as specified in Guided Tour #2 before proceeding. The display should show the Dynamic Processing module identifier. If not, repeat Guided Tour #2.

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GUIDED TOURS

WORKING WITH THE FILTER

You could activate the Filter Setup function directly by keying in 13. However, let's investigate another way to select the Filter function. Move the data slider to catalog the various Dynamic Processing functions. When the display shows function 13, **Filter Setup**, press **ENTER**.

CHANGING FILTER CUTOFF FREQUENCY

1. Refer to **DYNAMIC PROCESSING 13**. The display should look like the one in Step 1 of **DYNAMIC PROCESSING 13**.

2. Play with the cursor buttons (the left and right arrow buttons directly below the display). Note how you can move the cursor under the various parameters to be adjusted. For now, move the cursor under Fc.

3. Vary the data slider. Note how the numbers under Fc change. Lower numbers mean a lower filter cutoff frequency (less high frequencies). Higher numbers mean a higher filter cutoff frequency (more high frequencies). Observe how only the notes within the current voice are affected by the slider setting.

Note: You must re-trigger a note to hear any changes. Holding down a note and playing the slider will not change the sound; you must play a note after changing the slider to hear the results of changing the slider. This is true when making any changes to the sound, not just while you're in the Filter function or the Dynamic Processing module.

By the way, now might be a good time to mention that although we are changing the sounds in the bank, the sounds on the disk remain unchanged. This is because we haven't saved the bank to disk. Thus, you can fool around with the bank sounds as much as you want without having to worry about altering the original sounds on the disk.

CHANGING FILTER Q

1. Move the cursor under Q on the display. Vary the slider to change the sharpness of the sound; higher numbers give a sharper sound. Again, this affects only the range of notes covered by the current voice. Leave the Q at about 90 and proceed.

2. Move the cursor back to Fc and vary the data slider. Note how this produces a sort of wa-wa effect (remember, you have to re-trigger the key to hear the results of changing the Q).

3. Now set Fc and Q to about 50. The range of notes covered by the current voice should sound muted.

CHANGING THE FILTER CUTOFF ENVELOPE

1. Let's investigate the effects of envelope control over the filtered sound. Move the cursor under Env and use the slider to set a value of +40. This allows the envelope to control the filter cutoff frequency. (See **DYNAMIC PROCESSING 14**.)

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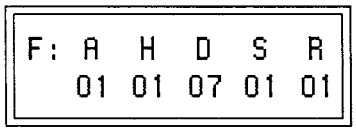
GUIDED TOURS

2. Now we need to change over to **DYNAMIC PROCESSING 14**. Press **ENTER** to exit from the current function (see **GENERAL INSTRUCTIONS 3**), and the display will show the module identifier.

3. Key in 14 to select the filter envelope parameters.

4. Move the cursor under A and vary the slider. With larger values, it will take more attack time for the filter frequency to go from lowest to highest cutoff frequency. Refer to **DYNAMIC PROCESSING 14**, vary the various envelope parameters, and observe the effect these changes have on the sound.

5. Now let's check out inverted envelopes. Set the envelope parameters as follows:



... and play and hold a chord. This is a non-inverting envelope in the sense that the envelope increases the filter cutoff frequency above the initial cutoff. To select an inverting envelope, where the cutoff decreases below the initial cutoff, exit Function 14 by pressing **ENTER** (this puts you back at the module identifier), then key in 13.

6. We're back at the familiar Filter Setup screen. Move the cursor under Env and select -40 to invert the envelope. Note that the envelope effect is not all that noticeable when you play a chord. This is because the envelope forces the cutoff frequency in a negative direction, and since the cutoff frequency is already fairly low, it can't go that much lower.

7. Now move the cursor under Fc and increase the cutoff frequency to around 90 or 100. The effect will be far more noticeable since there will be more range available for the negative-going envelope excursion.

8. If you feel like experimenting, play with the Trk control to affect the way the filter frequency tracks the keyboard pitch (see **DYNAMIC PROCESSING 13**).

9. Before proceeding with the Tour, set Fc=100, Q=00, Env=+00, and Trk=1.00. Set the envelope to A=01, H=01, D=01, S=32, and R=05 (**DYNAMIC PROCESSING 14**). After entering these values, press **ENTER** to return to the module identifier.

FUN WITH VCAS

1. In preparation for the following experiments, let's change the current voice to include the entire keyboard. Enter 00, then press Enter twice. You have now selected the entire keyboard.

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GUIDED TOURS

2. Now key in 12 to select the VCA function. Referring to **DYNAMIC PROCESSING 12,** move the cursor under the various envelope parameters and see how different settings affect the sound.

3. Before moving on, make sure you have a sound that is fairly sustained with little or no envelope attack time.

■ *Pressing the* ***Enter*** *button twice in succession will also select all voices.*

OTHER DYNAMIC PROCESSING OPTIONS

1. Key in 11, refer to **DYNAMIC PROCESSING 11,** and note how the controls affect the sound.

2. Let's add some LFO effects. Key in 16 and position the cursor under each display option. Vary the data slider and observe how this affects the sound. Note that adding LFO to Fc might not sound all that noticeable; if you want a more obvious effect, bounce back to function 13 and set Fc to about 50 and Q to about 50. This should make the LFO's effect more noticeable.

3. If the LFO settings aren't to your liking, then key in 15 to change the LFO rate, delay and variation (as explained in **DYNAMIC PROCESSING 15**).
and filter envelope attacks, as well as panning. Refer to **DYNAMIC PROCESSING 18** as you experiment with different settings. Remember that the velocity-to-envelope attack setting interacts with the initial envelope attack settings; if you don't take our word for it, then by all means call up the envelope attack parameters for the filter and VCA and see how different values interact with different velocity values.

GUIDED TOUR #4:
REALTIME CONTROL PROGRAMMING

BACKGROUND

Ever wanted to add vibrato to a grand piano? Or bend its pitch? The Realtime Control module can do this, and lots more. Begin this Tour by re-loading Arco Strings (Piano & Strings), then select Preset 10 (Demo Strings).

PITCH-BENDING

First, let's check out pitch-bending. Play middle C and rotate the pitch bend wheel. Hmm...no pitch bend. Now play A5, and there will be pitch bend. Check further, and you'll see that pitch-bending affects only the range from A#3 to C7. This is because pitch bend can be enabled for any voice or voices within a preset. In this case, pitch bend was only enabled for the voices that span from A#3 to C7 (voices 07-12).

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GUIDED TOURS

Let's have pitch bend affect the entire keyboard. Key in **DYNAMIC PROCESSING 22** and select the entire keyboard as the current voice (surely you know how to do this by now, so we'll spare you the details). Move the cursor, and you'll see a list of modulation destinations. Pitch will be set to **ON**. Press **YES**, and like magic, you can now pitch bend the entire current voice.

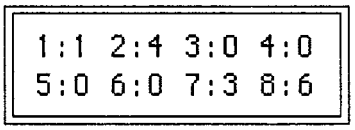
The important point of all this is that if modulation does not seem to affect a voice, *make sure that modulation is enabled.* Now read **DYNAMIC PROCESSING 22** for more information. Want to change the pitch bend range? De-activate the Dynamic Processing module, activate Preset Definition, and refer to **PRESET DEFINITION 8.**

CHANGING MODULATION WHEEL DESTINATIONS

Note: Emax II offers two vibrato options: Pre-programmed (which adds a constant, selectable amount of vibrato), and realtime (where the player adds in vibrato by using one of the wheels).
Each Emax II wheel can be assigned to a particular destination. For example, if the left wheel is assigned to pitch, then rotating the wheel bends pitch. If assigned to the filter, rotating the wheel varies the cutoff frequency.

Let's set up for the next part of the tour. Choose Preset 01 as the current preset if it is not already. Activate **DYNAMIC PROCESSING**, assign the entire keyboard as the current voice if necessary, then key in 22. Press the cursor buttons and press **YES** for all the enable options. This will make it easier to hear the results of the next series of experiments.

Now activate **PRESET DEFINITION** and key in 9. To make "live" playing as simple as possible, the display works somewhat differently for this module. The display shows eight pairs of numbers:



The first number of each pair stands for one of the eight possible control sources (the left-hand column of functions printed on the top panel under **Preset Definition 9**), namely:

1: Left wheel (center detent, spring return type)
2: Right wheel (continuously variable type)
3: Pressure (from external MIDI controller)
4: Control voltage pedal (plugs into rear panel PEDAL jack; also accepts any 0 to +10V control voltage source)
5: MIDI control A (can be assigned to any MIDI controller #)
6: MIDI control B (can be assigned to any MIDI controller #)
7: Footswitch 1 (plugs into rear panel FOOT SWITCH 1 jack)
8: Footswitch 2 (plugs into rear panel FOOT SWITCH 2 jack)

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GUIDED TOURS

The second number of the pair represents a control destination (the right-hand column of functions printed in the module) which you assign to a control source.

Each of the destinations printed in the upper right-hand column (0-9) can be controlled by control source 1, 2, 3, or 4, or via data sent over MIDI. For more information on MIDI, see **PRESET DEFINITION 7** ("MIDI Setup") and the Advanced Applications section of this manual.

Each of the destinations printed in the lower right-hand column (0-6) can be controlled by sources 7 and 8.

You'll be happy to know that real time control settings are memorized for each individual preset. Thus, if desired each preset can react to the real time controls and MIDI controllers in different ways.

SELECTING A CONTROL SOURCE and CONTROL DESTINATION

1. With Arco Strings, preset 10 as the current preset, and **PRESET DEFINITION 9** activated, select the left wheel as a control source by keying in **1**. The cursor will flash underneath the number to the right of the chosen control source number, thus indicating that Emax II is ready for you to key in the control source's destination.

2. The left wheel should be assigned to **1** (pitch). Vary the wheel and check that the keyboard pitch is indeed affected. If sections of the keyboard are not affected, check that pitch control is enabled (**DYNAMIC PROCESSING 22**). Now press **2**; this assigns the left wheel to Filter cutoff. Rotating the wheel towards you should produce a more muted sound. Key in **3**, and the left wheel will affect overall volume. If you feel adventurous, check out the other control destinations. Note that if you select a destination that is already specified for one of the other control sources, the old assignment will be de-selected and that control source will be turned off (**0**).

3. Think about it for a bit...the left wheel can control a destination, the right wheel can control a different one (as can the pedal), and there are MIDI control possibilities too. These assignments can be different for each preset, and particular controller destinations can be disabled for different presets and voices. We're talking versatility here, so if you feel like taking out the next couple of hours and checking out all the possibilities, be our guest! Note: When assigning the footpedal, make sure it's plugged in to prevent unpredictable results.

4. Oh yes, and there are footswitches too. But before experimenting with the footswitches (sources 7 and 8), we need to understand the difference between looped and unlooped sounds. Looping is described more fully in **DIGITAL PROCESSING 2** and **DIGITAL PROCESSING 3**, but basically, a "sustain looped" sound is one where a portion of the sound is put into an "infinite repeat" loop for as long as you hold down the key. This is similar to the infinite repeat function on digital delay lines. Looping allows for sustaining a normally non-sustaining sound for as long as you like. An unlooped sound is not artificially sustained, and therefore lasts its normal length.

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GUIDED TOURS

GUIDED TOUR #5:
BASIC SAMPLING

BACKGROUND

Sampling does not just involve sticking a microphone in front of something—sampling is an art. This Guided Tour gives you the basics, and also lays the groundwork for the guided tour of the Digital Processing module.

SETUP

1. Plug a microphone into the rear panel Sample Input jack (an instrument can also be used, but a mic is easier to work with for now).

2. Erase the bank memory (**MASTER 4**). This gives us maximum sampling time.

3. Set the level (**SAMPLE 1**). The default keyboard placement will work for now, but if you want to change it, see **SAMPLE 2**. Also set the sampling rate (**SAMPLE 3**). This should be at 39 kHz; might as well leave it there for now. Check the available sampling time (**SAMPLE 4**), which should be at least 13.4 seconds.

4. Set the threshold (**SAMPLE 5**), arm the sampling process (**SAMPLE 6**), and you're ready to sample! Speak into the mic; as soon as the level exceeds the threshold, the display will say "sampling." Feel free to talk away for 13.4 seconds, but if you lose patience, press 8 to stop sampling.

5. Play the keyboard in the assigned range (lower keyboard, C1-B1) to hear the results of your sampling.

6. Now experiment with more sampling: Try setting a particular sample length (**SAMPLE 4**), using forced sampling instead of threshold-sensitive sampling (**SAMPLE 7**), assigning the sampled sound to other portions of the keyboard (**SAMPLE 2**), and also, practice terminating the sampling process (**SAMPLE 8**). As long as you do not de-activate the module, new samples will replace previous samples on the keyboard.

7. To save the sample as part of a preset, de-activate the sample module. Since memory was cleared prior to sampling, Emax II created a preset (00) called "Untitled," and this is the preset that holds your new sample. Had you sampled into a bank with existing presets, the sample would have been stored with the current preset. If you wanted to sample into a new preset, you would have first had to create a preset (**PRESET MANAGEMENT 3**) in which the sample could reside.

8. Let's try another sample. Activate **SAMPLE 2** to change the current voice. Notice that Emax II, a very polite instrument, doesn't overwrite the existing sample without your express permission; thus, the new sample is automatically assigned to the next higher octave. This assignment can always be modified with **SAMPLE 2**. Also note that if you're ever in a position where you're going to overwrite an existing sample, Emax II will notify you via the display.

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GUIDED TOURS

GUIDED TOUR #6:
DIGITALLY PROCESSING SAMPLES

BACKGROUND and SETUP

Digital processing allows for radically altering voices stored in the bank. In this Guided Tour, we'll learn — among other topics — how to truncate, loop, reverse, splice, and combine samples. First, though, we need to take a couple of samples with which we can practice.

1. Clear the bank of memory (**MASTER 4**).

2. Follow the directions in Guided Tour #5 and make a sample of yourself speaking. However, select a 4 second sample length (**SAMPLE 4**). After setting the threshold and such, arm sampling and start jabbering.

3. De-activate the sample module, then re-activate and take another 4 second sample. You will not have to do any setup — just hit **SAMPLE 6** and talk away. You now have two samples suitable for experimentation.

CHOOSING THE CURRENT VOICE

Activate **DIGITAL PROCESSING**. You will be asked to select a voice, so press a key within the range of the voice that you want to work on and press **ENTER**.

TRUNCATING A VOICE

1. Choose **DIGITAL PROCESSING 1** to truncate the ends from voices.

2. Vary the data slider as you play a key in the range assigned to the current voice. Notice the start of the voice will disappear. Use this technique to get rid of silence at the start of a voice or for effects.

3. Move the cursor using the arrow keys to the End display. Use the data slider to truncate any undesired part off the end of the sample.

4. When you get tired of truncating, press **ENTER**. When Emax II asks if you want to "Make Truncation Permanent?", enter **NO** so that the full sample is available for subsequent experiments in this tour.

5. If desired, change the current voice (**DIGITAL PROCESSING 0**) and experiment with truncating the other sample you took. Again, when asked if you want to "Make Truncation Permanent?", press **NO**.

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GUIDED TOURS

LOOPING A VOICE

1. If you haven't yet done so, activate the **DIGITAL PROCESSING** module and assign the current voice. Select function 4 and turn the loop mode **ON**.

2. Refer to **DIGITAL PROCESSING 2** to graphically see how looping affects a sample. If you play and hold a key in the current voice, it will play indefinitely since the loop function is on.

3. Now try modifying the loop. Activate **DIGITAL PROCESSING 2** and adjust the Start and Length values. Note that if the length equals the full length of the sample, you will not be able to set a new start point. Reduce the length, and you should be able to adjust the start point. For practice, try looping individual words or sentence fragments.

A PRACTICE SAMPLING SESSION

1. Plug a microphone into the rear panel sample input jack.

2. Erase all memory (Use **MASTER 4**). This erases the bank, not the disk.

3. Set the level (**SAMPLE 1**). Sing "ahhhh" into the microphone (This is an easy sound to loop). The VU level should not quite reach the top of its range. Adjust the gain (use the data slider) until a good level is attained.

4. Set the threshold (**SAMPLE 5**). This should be set about 5 or 6 bars from the left. When the input sound exceeds this level, recording will start.

5. OK, now get ready to sing "ahhhhh" and press (**SAMPLE 6**) to arm the sampling process.

6. Now sing "ahhhhh". When you are out of breath, press (**SAMPLE 8**) to stop sampling.

7. Play the keyboard in the assigned range (lower keyboard, C1-B1) to hear the results.

8. Now we can truncate the silence from the beginning and end of the sound. Press (**DIGITAL PROCESSING**), the display will say: Select a Voice. Play a key in your sample range (C1-B1) and press **ENTER**. Now press **1** to select truncation.

9. Adjust the start and end points by moving the slider to remove any silence or unwanted portion of the sound (You must play the keyboard after you move the data slider in order to hear the results of the slider change). Press **ENTER** then **NO** to exit truncation.

10. Now we are ready to loop the sound. Press **2** to select looping. To loop, first move the data slider to make the loop length about 10,000 to 14,000 samples long. Next move the start point into the sustained portion of the ahhh sound so that the ticking sound becomes softer. When you get a fairly good loop press **ENTER**. The display says:

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GUIDED TOURS

Autoloop Y/N. Press **YES**. You now should have a fairly good loop. If not, adjust the start point and again press autoloop. It takes practice, but you'll get it. That's it! Feel free to play around with other processors such as chorus and LFO.

11. In summary; these are the steps you will go through every time you have a sampling session (of course you will develop your own order and style of doing it).

- Take the sample
- Truncate the sample
- Loop the sample (if desired)
- Assign the voice to a keyboard position
- Continue to refine and make presets

TIME TO SAVE?

Maybe you haven't created any masterpieces during these experiments...but maybe you have. If you want to save a preset to disk, take your blank formatted disk prepared in the last Guided Tour and Save All 16 bit (**PRESET MANAGEMENT 8**). Moral of the story: Always have a blank formatted disk around (or an empty hard disk bank) just in case you come up with something you want to save.

GUIDED TOUR #7:
MANAGING THE BANK

BACKGROUND AND SETUP

The following functions don't necessarily do glamorous things, but they are very useful. This Guided Tour acquaints you with these utilities.

Begin by loading the Arco Strings (Piano/Strings) bank.

ERASING A PRESET

Refer to **PRESET MANAGEMENT 4** and erase Preset 01. Don't worry, this is just gone from the bank, not the disk. And we can get it back anyway by...

LOADING A PRESET

See **PRESET MANAGEMENT 1** and load Preset 01. Now it's back in the bank again.

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GUIDED TOURS

OTHER BANK MANAGEMENT FUNCTIONS

The other functions—copy, rename, create, and preset size— are pretty much self-explanatory. Refer to **PRESET MANAGEMENT 5, 6, 3**, and **7** respectively. Try these various functions to get a feel for how they work. **PRESET MANAGEMENT 8** lets you save the bank to disk.

GUIDED TOUR #8:
THE SEQUENCER

The Emax II sequencer is a "scratchpad" for musical ideas, and is not intended to be a sophisticated do-all whiz-bang. However, you can create sequences on a fancy computer and, using Supermode, download these sequences via MIDI into the sequencer (**SEQUENCER SETUP 6**).

For now, we'll check out how the sequencer works as a scratchpad, so load the Arco Strings bank, activate **SEQUENCER MANAGE**, and let's go.

1. Key in 1 to set the tempo. While you're at it, activate **SEQUENCER MANAGE 2** and make sure that the Emax II clock is on Internal. The other Sequencer Manage options—Load, Erase, Copy, and Rename—are described under **SEQUENCER MANAGE 3** through **6**.

2. Now press **SELECT**. Enter sequence numbers 01, 02, 03 etc. from the keypad, until you find one that says, "Empty Seq". This is the sequence into which we will record.

3. Press **RECORD**, then **PLAY**. Start playing the keyboard immediately when you press play. When you've played enough, press **STOP**.

4. To play back the sequence, press **PLAY**. Varying the data slider will change the tempo. The display will show this is an untitled sequence; practice renaming it with **SEQUENCER MANAGE 6**.

5. To stop the sequence at its end, press **STOP** once. To stop it immediately, press **STOP** twice.

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MECHANICAL PROCEDURES

MECHANICAL PROCEDURES

PRECAUTIONS

Observe the following precautions when working on the Emax II:

Do not bend or strain the PCBs or you may cause tiny breaks in the printed circuit traces which will be very difficult to find.

Switch power off before disconnecting or connecting any circuitry, or removing or installing PCBs.

To replace soldered components, switch power off, remove the PCB completely from the instrument, and desolder from both sides. Use a vacuum desoldering tool. The traces on the Emax II circuit boards are very thin. Use extreme care and work carefully. Heat the pin, ***not*** the pad.

If you are not an expert desolderer, it may be best to actually "clip out" the suspect part, then desolder the leads, rather than risk damage to the board traces.

DO NOT try to remove the surface mounted ICs or you may ruin the PCB.

KEYBOARD EMAX II

NOTES ON EMAX II SCREWS

Particular care must be exercised when removing and replacing screws on the keyboard Emax II. Many of the screws are the self-tapping type and will strip out the plastic if they are tightened down too hard. Other screws mate with Pem-serts, which are easily pulled out from the plastic housing. Make sure that the Pem-serted screws go in smoothly.

■ If a screw is cross-threaded, simply replace it with a new screw.

■ If the Pem-sert is pulled out from the plastic housing, don't worry. It can be welded back in place by heating it up with the tip of your soldering iron.

■ If a self-tapping screw strips out the plastic, either insert a Pem-sert, or fill with a strong glue such as "Black Max" or "Epoxy", then re-insert the original screw.

THE SERVICE POSITION

Before taking the Emax II apart we recommend providing a soft work surface. A carpeted or rubber covered workbench is ideal. Place the Emax II upside-down on the padded workbench so that the keyboard is toward you. This will allow you to play the keyboard and have the jacks toward the rear of your bench. Using L-shaped audio plugs will allow you to tilt the unit back so that you can see the controls and display. Be especially careful not to break the plastic jacks if you use straight ended phone plugs.

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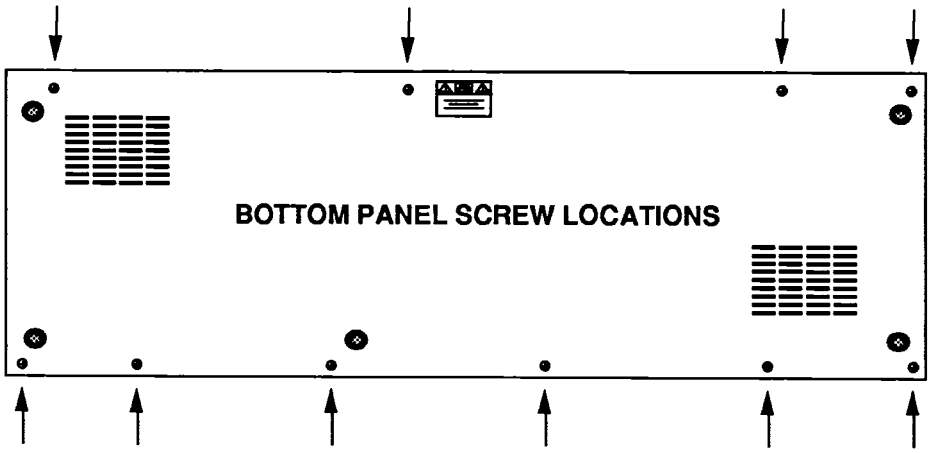
MECHANICAL PROCEDURES

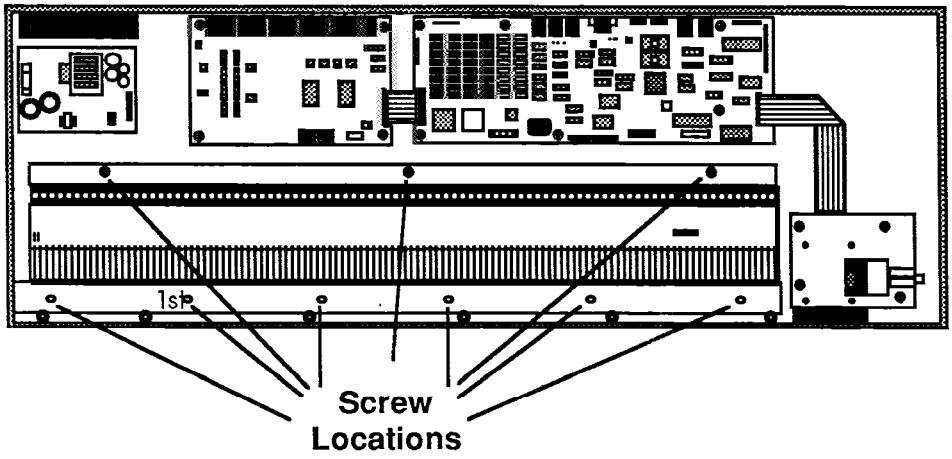


REMOVING THE BOTTOM PANEL

Remove the (10) 8-32 x 1/4" bottom panel screws (HS 327) from the perimeter of the bottom panel, then lift off the aluminum panel. When replacing the bottom panel screws, be very careful not to cross-thread the screws into the brass Pem-serts.

REMOVING THE FLOPPY DISK DRIVE

To remove the floppy disk drive, the drive bracket must first be removed. The drive bracket is mounted to the plastic housing by (4) 8 x 1/2" self-tapping phillips screws (HS 364). The disk drive itself is secured to the bracket by (4) 4-40 x 1/4" machine screws (HS 353). These may be removed after removing the power and data cables from the floppy drive.



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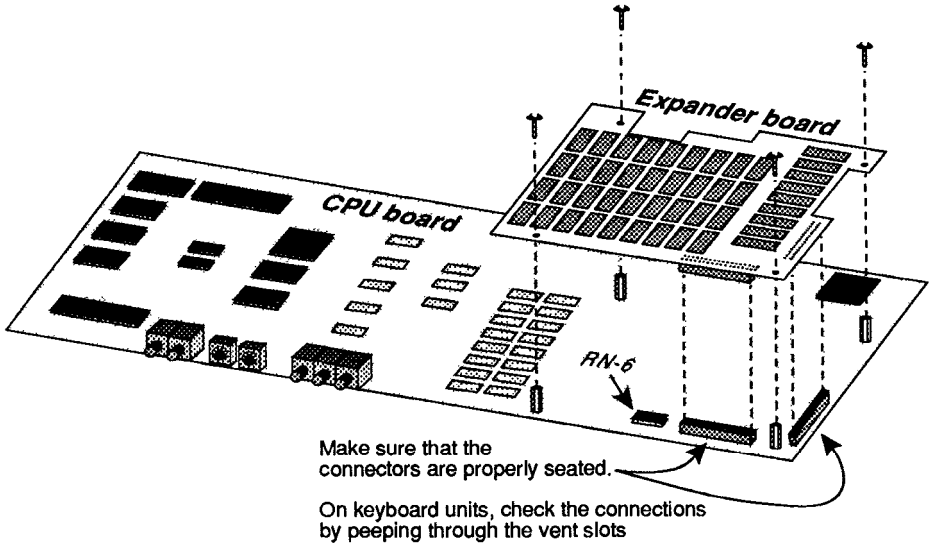
MECHANICAL PROCEDURES

REMOVING THE POWER SUPPLY

The switching power supply is mounted directly to the plastic housing by means of (4) 6 x 3/8" self-tapping screws (HS 363). Remove all the electrical connections to the supply before removing the screws. In some cases there may be an in-line connector to the 110/220 selector switch which carries 110 Volts. Make sure that there is no exposed metal on this connector. If there is, heatshrink it!

REMOVING THE MEMORY EXPANSION BOARD

The memory expansion board (if any), is attached to the CPU board by means of (4) 1/2" hex standoffs (HS 406) and (4) 6-32 x 1/4" machine screws (HS 353). After the screws are removed, wiggle the expansion board slightly while gently pulling up to remove it. When reinstalling the expansion board, make sure that the connectors are properly seated. There will be an audible "click" with proper installation.



REMOVING THE CPU AND OUTPUT BOARDS

The CPU board is mounted to the housing using (2) 6-32 x 1/4" machine screws (HS 353) and (4) 1/2 " hex standoffs (HS 406). the screws and standoffs mate with Pem-serts molded into the plastic housing. All electrical connections to the CPU board should be disconnected before any screws or standoffs are removed. The output board has only four mounting screws (HS 353) and one connector.

REMOVING THE INTERNAL HARD DISK DRIVE

The internal hard disk (if installed) is attached to a mounting plate (EM 365) by means of (4) machine screws (HS 372) and (4) spacers (HW 373) as shown in the diagram below. The plate cannot be attached incorrectly. The screws should be fairly tight, but do not overtighten. The hard disk and mounting plate assembly is mounted to the plastic

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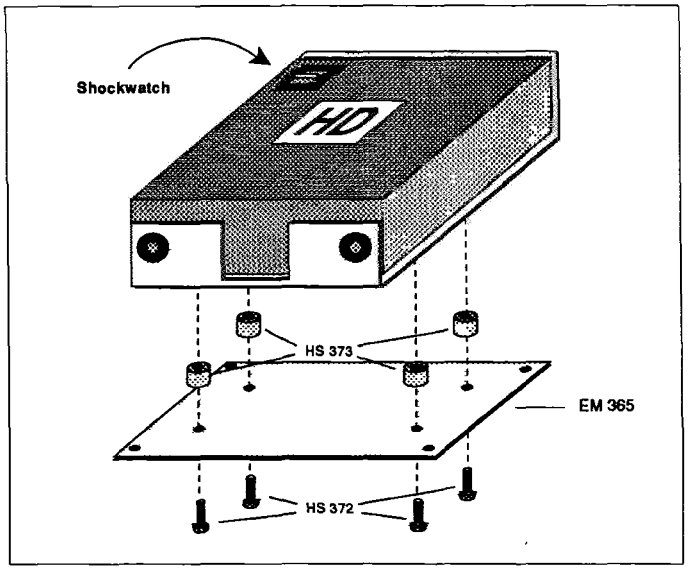
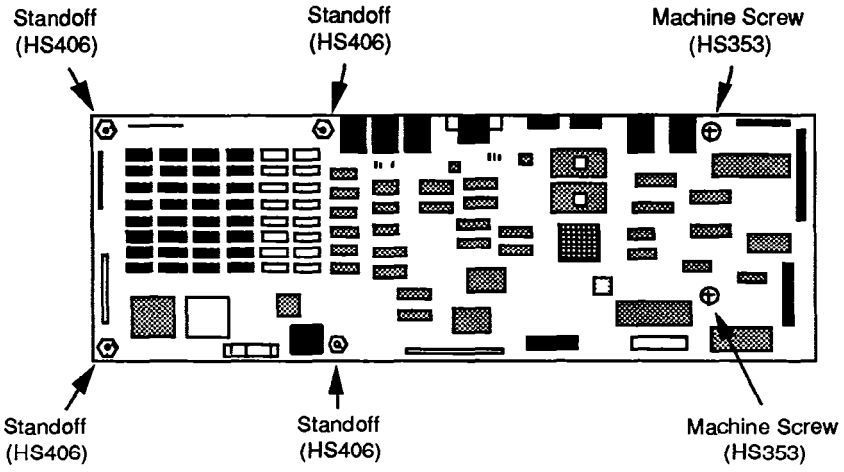
MECHANICAL PROCEDURES

housing by means of (4) 8 x 1/2" self-tapping phillips screws (HS 370). Since the power and ribbon cables are hard to reach, they may be removed after the HD/plate assembly has been detached. The shockwatch indicator turns red if the hard drive has been subjected to extreme g-forces.



INTERNAL HARD DISK MOUNTING



EMAX II CPU BOARD

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MECHANICAL PROCEDURES

REMOVING THE KEYBOARD

Removal of the keyboard will not be necessary for most repair jobs. The Bad News: to remove the front panel board, you must first remove the keyboard assembly. Moan, groan, assorted curses,%#&!¥. The Good News is: it's not that hard to remove it!

TO REMOVE THE KEYBOARD:

■ First, disconnect the power plug from the CPU board and the flat ribbon cable from the keyboard circuit board.

■ Next, remove the (3) keyboard bracket screws (E-mu P/N HS 327) and the (5) or (6) screws (E-mu P/N HS354) from the front of the keyboard.

■ The keyboard assembly can now be carefully lifted out from the housing and set aside. When re-installing the keyboard, our assembly department recommends installing the second screw from the left first. This makes the screw holes line up better. If the end keys rub, a shim is glued to the end of the keyboard to center it correctly. Rubbing can sometimes be corrected by simply loosening the mounting screws and re-adjusting the keyboard.

REMOVING THE FRONT PANEL BOARD

To remove the front panel board, simply remove the (12) 6 x 3/8 self-tapping screws, (HS 363) and lift out the board. The rubber buttons will be left in the housing. When re-installing the panel, make sure that the LED's are straight and that the rubber buttons are fully seated before reinstalling.

RACK MOUNT EMAX II

THE SERVICE POSITION

Before taking Emax II apart we recommend providing a soft work surface. A carpeted or rubber covered workbench is ideal. Place the Emax II rack upside-down on the padded workbench so that the front panel is toward you. You should also have a MIDI keyboard within reach so that the Emax II may be played.

REMOVING THE BOTTOM PANEL

Remove the (10) 6-32 x 1/4" bottom panel screws (HS 368) from the perimeter of the bottom panel, then lift off the metal panel and place next to the main unit (see diagram) taking care not to pull the output board ribbon cable.
Note: Four of the bottom panel screws may also attach the rubber feet to the case. The bottom panel may be simply laid diagonally, resting on the edge of the rack case; or may

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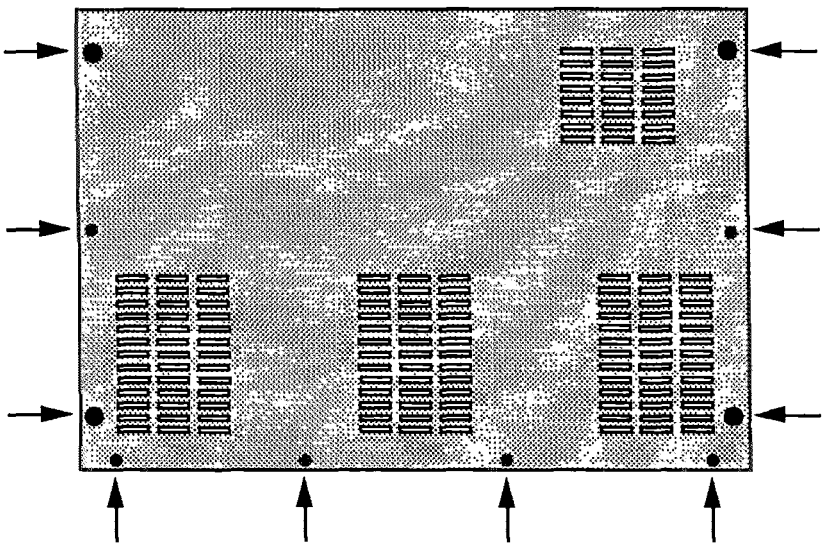
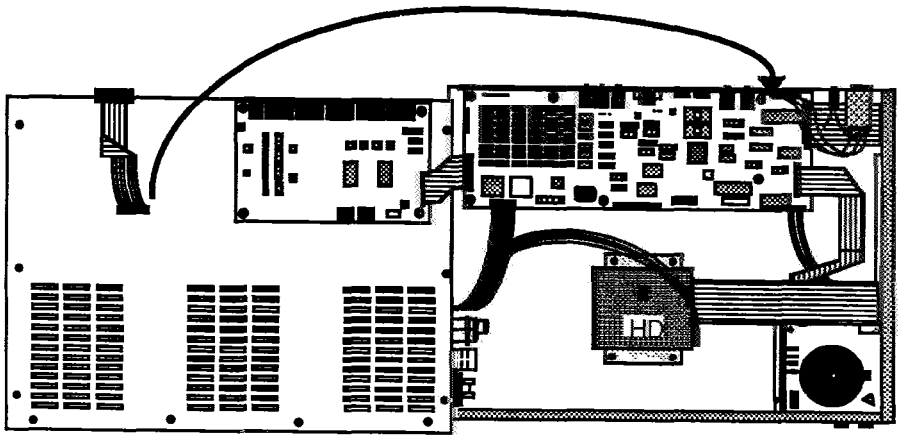
MECHANICAL PROCEDURES



RACK BOTTOM PANEL SCREW LOCATIONS



RACK SERVICE POSITION

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MECHANICAL PROCEDURES

be placed on top of some other object such as a box or large book to bring it up to the height of the rack case. With the Emax in this position, most of the circuitry can be easily accessed. Do be careful when first removing the panel that you do not rip the output board cable out from the circuit board.

REMOVING THE FRONT PANEL BOARD

The front panel board is secured to the rack chassis by means of (7) 6-32 x 1/4" machine screws (HS 336). The front panel needs to be removed in order to replace the slider pots or to clean the front panel buttons.

REMOVING THE POWER SUPPLY

The switching power supply is mounted directly to the side of the steel chassis by (4) 6-32 x 1/4" machine screws (HS 353). Remove all the electrical connectors to the supply before removing the screws. One of these connectors may be an in-line type which carries 110 V. Make sure that there is no exposed metal on this connector. If there is, heatshrink it!

REMOVING THE MEMORY EXPANSION BOARD

The memory expansion board (if any), is attached to the CPU board by means of (4) 1/2" hex standoffs (HS 406) and (4) 6-32 x 1/4" machine screws (HS 353). After the screws are removed, wiggle the expansion board slightly while gently pulling up to remove it. When reinstalling the expansion board, make sure that the connectors are properly seated. There will be an audible "click" with proper installation.

REMOVING THE CPU AND OUTPUT BOARDS

The CPU board is mounted to the housing with (6) 6-32 x 1/4" machine screws (HS 336). The rear panel jack nuts should be removed and the connectors to the CPU board disconnected before the screws are removed.

The output board has only (4) mounting screws (HS 336) and one connector. The rear panel jack nuts should be removed before the board mounting screws are taken out.

REMOVING THE FLOPPY DISK DRIVE

Care should still be taken not to harm the delicate traces on the front panel when removing the floppy drive. The drive brackets mount to the chassis by means of (4) 6-32 x 1/4" machine screws (HS 353). The drive mounts to the brackets by means of (4) 4-40 x 1/4" machine screws (HS 352).

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DIAGNOSTICS

DIAGNOSTICS

A complete functional test should be the first step in diagnosing a problem on the Emax II. Many times a complete functional will reveal important clues to the problem which might have have otherwise overlooked. Try to isolate the problem as much as possible through the operational controls, then go in with your instruments to nail it down. When dealing with a 16-bit audio system, a high quality amplifier and speaker system is a necessity in order to pick out subtle audio problems.

Although the microprocessor and output sections should not give you much trouble, certain sections of the Emax II may be more difficult to troubleshoot. Because of the difficulty associated with removing and resoldering surface-mount ICs, problems involving these chips should be referred to the factory. If you have isolated the problem to a suface-mount chip, a board swap is in order. Simply call the E-mu Customer Service Department to arrange for a board swap.

The Emax II contans a number of on-board diagnostic tests. These can be accessed or read from the front panel without even opening the unit!

NOTICE

Because of the complexity of the custom LSI chips and surrounding circuitry in the Emax II, the schematic diagrams for these sections have been deliberately omitted. Complex timing diagrams and theory beyond the scope of this manual are necessary to troubleshoot these sections. 99% of all Emax II problems can be diagnosed and repaired without knowledge of these chips. In fact, we even use the "shotgun" method here at the factory (it's faster). If you are ever in doubt about a particular problem, please don't hesitate to call us for assistance. We'll be happy to help. Call E-mu Customer Service at (408) 438-1921 between the hours of 8:30 am and 5:00 pm PST, Monday through Friday.

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DIAGNOSTICS

BOOTPROM DIAGNOSTICS

The bootprom diagnostic tests are invoked each time Emax II is powered up. On power-up, hardware in the Emax II turns on all LEDs. Hence, a completely dead CPU will probably have all LEDs lit. If all LEDs don't light on power-up, something in hardware is seriously wrong. If a test fails, the associated LED is not extinguished, but the subsequent tests are performed and a boot is attempted.

The LEDs are extinguished for the following reasons:

ENTER ---------- Turned off as the CPU's first instruction.

SEQUENCER ------ Turned off if CPU RAM is basically functional. No use of the RAM is made until after this test is performed.

TRANSPOSE ------ Turned off if the analog jack port is detected. This will remain lit if the analog board is not plugged in.

DRIVE SELECT ---- Turned off if LSI #2 can be written and read.

MASTER ---------- Turned off only if LSI #1 can be written and read AND there is working memory installed. (On Turbo units, the memory expansion board must be installed for this test to pass.)

SAMPLE---------- Turned off if the 8254 timer works.

DIGITAL PROC.---- Turned off if the MIDI/RS422 UART works.

PRESET MAN.------ Turned off if the scanner is present and initialized.

PRESET DEF. ------ Turned off if the floppy controller can seek to track 00. This requires that both the floppy chip and the drive be connected.

DYNAMIC PROC.-- Turned off after a complete software boot.

(Emax II *will* boot with the output board disconnected.)

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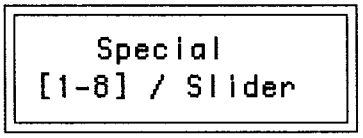
SPECIAL FUNCTION DIAGNOSTICS

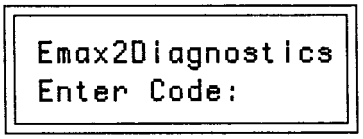
These on-board tests are hidden from the user in the Special Functions menu. They may be accessed in the following manner:

1. Activate MASTER, 9 (Special). The following screen is displayed.

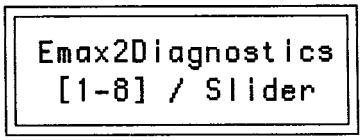


2. To enter the hidden diagnostics, press **9** on the keypad.
Remember: ***1 number past the last choice.***

3. The display now reads:



4. The Secret Code is: **3 - 6 - 2 - 9** *or* Emax spelled on the telephone dial.
The display now says:



4. The test number may be selected either with the data slider or by entering the test number on the numeric keypad. If the slider is used, start the test by pressing the Enter switch. These are the test options:

1	Bank RAM Test
2	GRAM Test
3	RS422 Test
4	Write/Verify Fl Test
5	Verify Floppy Test
6	Panel Test
7	Adjust Features
8	HD Diagnostics
	Serial Number

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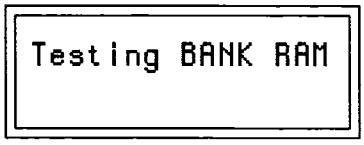
DIAGNOSTICS

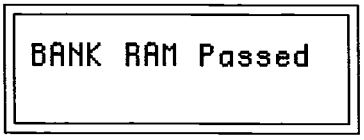
1 BANK RAM TEST

Tests the bank portion of the 32CG16 RAM. This is the same RAM that the diagnostics are running from, so this RAM probably has to be working in order for the test to run in the first place!

When this test is selected, the display will say:

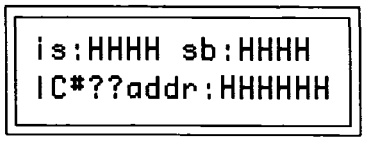


When this test passes, the display says:



2 G-RAM TEST

Tests theEmax II Sound RAM. The test makes two passes of writing, then reading from RAM. If an error is found, the display shows:



The top line of the display shows what the data is and what is **should be.**
The address of the error is shown on the bottom line.

The IC# display is a great idea in theory, but unfortunately, it does not work. Oh, well. Since there are not that many memory chips in the Emax II, the bad IC can be found quickly by first determining which bit is bad (convert Hex-to-binary) and then swapping around the chips corresponding to that bit.

This is a very thorough memory test which should be able to find any type of memory error.

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MEMORY TROUBLESHOOTING CHART

Main Board 256K RAMs

Bits	0-3	4-7	8-11	12-15
IC #	46	47	48	49
	50	51	52	53
	56	57	58	59
	60	61	62	63

Main Board 64K RAMs

Bits	0-3	4-7	8-11	12-15
IC #	64	65	66	67
	68	69	70	71
	73	74	75	76
	77	78	79	80
	82	83	84	85
	86	87	88	89
	92	93	94	95
	96	97	98	99

Memory Expansion Board

Bits	0-3	4-7	8-11	12-15
IC #	4	3	2	1
	8	7	6	5
	12	11	10	9
	16	15	14	13
	20	19	18	17
	24	23	22	21
	28	27	26	25
	32	31	30	29
	36	35	34	33
	40	39	38	37
	44	43	42	41
	48	47	46	45

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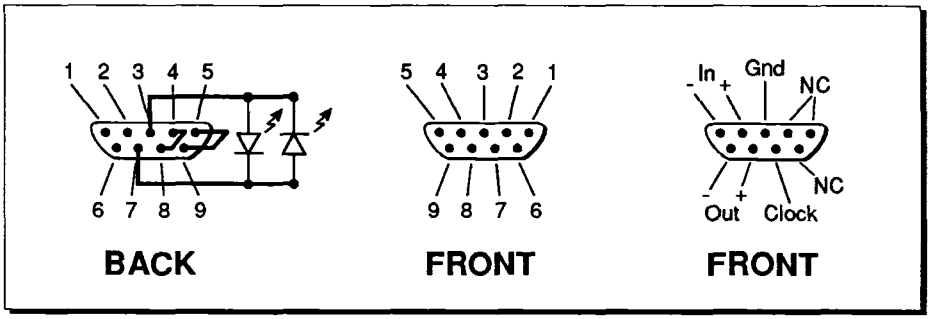
DIAGNOSTICS

3 RS-422 TEST

This test writes and reads an AA and then a 55 to the RS-422 port. The test waits a reasonable length of time for each response. If there is no response, it records a timeout error. In order for the test to work, a jumper plug must be inserted into the RS-422 jack on the back panel. The LEDs show that the 500KHz clock is running. If you do not wish to make the test plug, simply connect pins 4 and 8, and pins 5 and 9 together with clip leads. To test the 500KHz clock, monitor pin 7 with your oscilloscope. This test also checks most of the MIDI circuitry as well as RS-422 since they both share the same UART. See the functional test procedure for a dedicated MIDI test.

Construction of the RS-422 Test Plug: This will come in handy if you plan to repair many Emax's. It allows you to test the UART and Clock in one operation. To build the test plug, you will need: A 9 pin D-type female RS-422 connector, 2 LEDs, and 2 small pieces of wire. Wire the test plug as shown in the diagram below.



RS-422 Test Plug

4 FLOPPY WRITE/VERIFY TEST

This test writes and reads worst case data patterns in a butterfly seek pattern. It starts at the OD (outside diameter) of the disk, jumps to the ID (inside diameter), then back to 1 track in from the OD, 1 track in from the ID, etc. etc. The display shows the number of passes, hard and soft errors. Use a blank formatted Emax II disk, as this test is destructive to disk data. A reminder prompt is given upon entry to this test. The test runs until the disk is removed.

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5 FLOPPY VERIFY TEST

Requires a disk that has been run through at least one pass of the Write/Verify test (test #4). It runs a butterfly pattern while verifying the data as in the previous test.

	Pass ---------Test Passes
ERRORS ------>	Hard --------2 Passes Failed
	Soft----------1 Pass Failed, 1 Pass Good

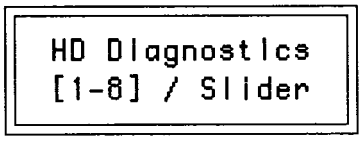
6 PANEL TEST

All the panel buttons will either toggle the corresponding LED or display their value on the screen if there is no LED. Pressing ENTER twice in succession, exits the test.

7 ADJUST FEATURES

This function allows a technician in the field to restore software dependent features (such as memory size and stereo sampling) in cases where the EEPROM has been erased or damaged. If you have an Emax II that has forgotton what options it has, call the factory for instructions.

8 HD DIAGNOSTICS



1 HD Select Drive - Allows you to select any currently mounted drive.

2 HD Read Only - Non-Destructive. Exercises (reads) the entire HD media for data read errors. Runs continuously. Press and hold ENTER to quit. Exiting the drive in this manner sets the drive error correction to ON.

3 HD Read/Reassign - Potentailly Destructive. Same as Read Only, but first turns error correction OFF and re-assigns bad blocks using the drive block assignment.

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DIAGNOSTICS

4 HD Write/Read/Reass - DESTROYS ALL DATA! Exercises the entire HD media by writing a test pattern, reading it back, and comparing. Runs continuously. Drive must be reformatted after this test with the Emax II format disk utility. This installs the file system to allow the Emax II to recognize the drive. Press and hold ENTER to quit.

5 HD Error Correct - Allows investigation and change of the drive error correction state. Should be set to ON after the diagnostics are completed.

6 HD Result - SCSI Sense Key and Sense Code, Sector Number and Status of the last HD operation.

7 HD Media Defect - Displays the HD's defect list in Hex.

8 Exit HD Diagns - Returns you to the Diagnostics submodule.

SERIAL NUMBER

This feature was originally intended to discourage theft by entering the unit's serial number into the EEPROM. The feature was not implemented.

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FUNCTIONAL TEST

FUNCTIONAL TEST

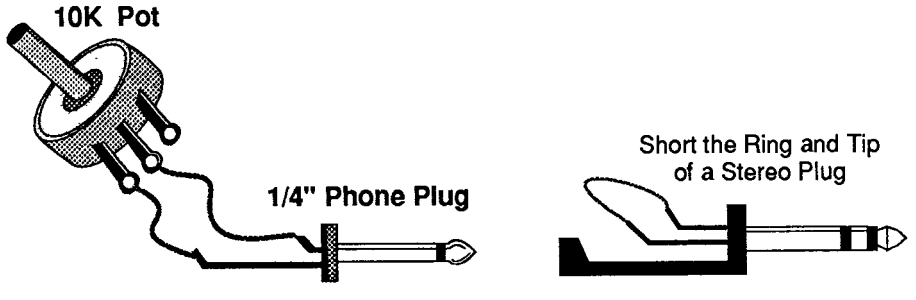
This is part of the functional test that is performed on every Emax II before it leaves the factory. A functional test can be performed to verify that a problem exists or as a final test to verify that the unit is working perfectly before you return it to the customer.

Equipment Needed:

Amp and Headphones
2 mono audio cables (w/phone plugs)
MIDI Cable
Sample source (radio, generator, mic)
Sync source
RS-422 test plug
Footpedal simulator
Audio return plug (2)
Footswitch
Emax II Test Disk
Scratch diskette

FOOTPEDAL SIMULATOR AND AUDIO RETURN PLUG

To test and calibrate the footpedal input, either an Emax footpedal or a footpedal simulator is required. The audio return plug is useful for testing the the submix outputs. Construction of the both devices is diagrammed below.



Footpedal Simulator **Audio Return Plug**

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FUNCTIONAL TEST

1. DIAGNOSTIC TESTS

Perform Diagnostic Tests 1 - 4.

1. Bank RAM Test
2. G-RAM Test
3. RS-422 Test (insert RS-422 test plug)
4. Panel Test (Press down on panel area of keyboard units to test for flex related LCD problems.) Plug in footswitch and check both footswitch jack inputs.
5. Check Memory Size. Clear memory - MASTER, 4. Check memory remaining - MASTER, 2.

	Sample	Preset
1 Megabyte:	0524244	0028021
3 Megabyte:	1572820	0028021
4 Megabyte:	2097108	0028021
5 Megabyte:	2621396	0028021
6 Megabyte:	3145684	0028021
7 Megabyte:	3669972	0028021
8 Megabyte:	4194260	0028021

2. CALIBRATIONS

1. Calibrate pitch wheel, mod wheel, data slider, volume slider and pedal. (MASTER, 9,3). Use the footpedal simulator to check the A/D Pedal input.

RECALIBRATE: **Master 9,3,1.** Move left wheel fo minimum post value in display. *Enter.* Rotate left wheel for maximum value. *Enter.* Return wheel to center position. *Enter. Yes. Enter.* Position right wheel for minimum value. *Enter.* Rotate right wheel for maximum value. *Enter. Yes. Enter.* Press key hard and hold. *Enter.* Press key softly. *Enter.* Release key. *Yes. Enter.* Plug in footpedal simulator. Move simulator to minimum value. *Enter.* Move to maximum value. *Enter, Yes. Enter.* Move data slider to minimum position. *Enter.* Move data slider to maximum position. *Enter. Yes. Enter.* Move volume slider to minimum position. *Enter.* Move volume slider to maximum position. *Yes. Master.*

Note: Pressure is not implemented, but pretend that it is. Also, leave a little dead space at the minimum and maximum positions on all settings.

Patch the Main Outputs of the Emax II into your stereo amplifier in preparation for the next few tests.

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FUNCTIONAL TEST

3. FUNCTION CHECK (Keyboard Units)

1. (Test Disk Preset 00). Play keyboard and check volume fader.
2. Move left wheel and verify pitch change.
3. Press Preset Definition, 9. Play G3 repeatedly while pushing 1, 0 and 1,1. Listen and verify no pitch change. Verify no vibrato with right wheel all the way down.

4. OUTPUT CHECK

1. (Test Disk Preset 02). Play keyboard and check headphone and mono outputs.
2. (Test Disk Preset 13). Play G2 and verify sound moving left and right through main outputs. Play at least 16 notes.
3. (Test Disk Preset 14). Insert two audio return plugs into Sub A outputs. Play the keyboard and listen for left/right panning.
4. (Test Disk Preset 15). Insert two audio return plugs into Sub B outputs. Play the keyboard and listen for left/right panning.
5. (Test Disk Preset 16). Insert two audio return plugs into Sub C outputs. Play the keyboard and listen for left/right panning.

Note: If there are no plugs inserted into the Submix Outputs, Emax II will sense this and the sound will be directed to the Main Outs.

5. MIDI CHECK

1. (Test Disk Preset 07). Connect MIDI cable between MIDI In and Out jacks.
2. Play G2 and hold it down.
3. Unplug one end of MIDI cable and release G2. Verify that the note sustains.
4. Re-insert MIDI cable and play G2 to verify that the note stops.

6. SYNC CHECK

1. Press sequencer *Play*. Verify that the sequence plays.
2. Turn amp volume down. Briefly insert one audio cable into Clock Out jack and listen for buzzing sound. Press *Stop* twice.
3. Press *Sequencer Manage*, 2. Move slider up to select *Click 24*. Press sequencer *Play*. (Emax II is waiting for external sync.)
4. Connect clock out from Drum Box or Signal generator (approx. 50Hz) to Clock In on Emax II. The sequence should start playing.
5. Vary the external clock tempo and verify that Emax II follows the tempo changes perfectly.
6. Unplug sync input and verify that sequence stops. Press *Stop* twice.

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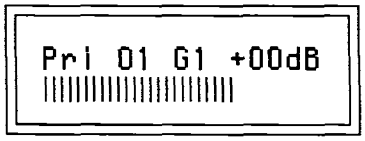
FUNCTIONAL TEST

7. SAMPLE CHECK

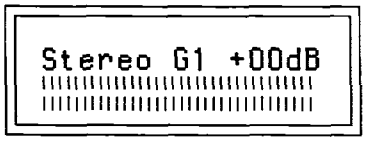
1. Press *Master, 4, Yes,* to erase memory.
2. Press *Sample, 3* and set sample rate to 39KHz.
3. Press 4. Select maximum sampling time.
4. Connect sample source (synth, signal generator, radio, mic) to sample input jack. (If the Emax II is stereo, use a stereo plug and select stereo sampling *Sample, 2.*
5. Press *Sample, 1.* Use the data slider to adjust the gain for optimum level.

■ *Using the optimum sampling levels as shown will produce samples will the lowest possible amounts of noise and harmonic distortion.*

OPTIMUM SAMPLING LEVELS



Mono Emax II



Stereo Emax II

6. Press 7 to sample. Play sample for the entire duration and listen for distortion and noise. The original key is shown in display.

8. FINAL CHECK

1. Play the unit for a few minutes as a reward for your hard efforts.
2. Reassemble. Shake unit and verify no loose parts.

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EMAX II TEST DISK

P00	Lovely Vibes	Play-test preset. Tests pitch and mod. wheels. Test to make sure a key plays before it reaches bottom of travel.
P01	Plinky Vibes	Play-test preset.
P02	Wintermute	Play-test preset. Tests pitch and mod. wheels.
P03	Wintermute 2	Play-test preset.
P04	Woofer Pulse	Check envelopes, filter sweep and resonance.
P05	Woof Woof	Play-test preset. Uses chorus, LFOs, velocity, filters.
P06	Woofer Q	Play-test preset.
P07	Free Synth	Play-test preset. Tests chorus function.
P08	Free Synth 2	Play-test preset.
P09	Angel Organ	Play-test preset.
P10	Angel Organ 2	Play-test preset.
P11	Square Synth	Play-test preset.
P12	SquareSynth2	Play-test preset.
P13	Main Panner	Tests panning function on Main Outs.
P14	Sub A Panner	Tests panning function on Sub A Outs.
P15	Sub B Panner	Tests panning function on Sub B Outs.
P16	Sub C Panner	Tests panning function on Sub C Outs.
P17	Pedal Test	Tests control pedal function.
P18	Silence @ G3	Silent sample.
P19	100Hz Sine	100 Hz sine wave across entire keyboard.
P20	1 KHz Sine	1 KHz sinewave across entire keyboard.
P21	15 KHz Sine	10 KHz sine wave across entire keyboard.
P22	100Hz Square	100 Hz square wave across entire keyboard.

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EMAX II TEST DISK (continued)

P23	1KHz Square	1 KHz square wave across entire keyboard.
P24	15KHz Square	15 KHz square wave across entire keyboard.
P25	100 Sine Shift	100 Hz sine wave pitch shifted.
P26	1K Sine Shift	1 KHz sine wave pitch shifted.
P27	15K Sine Shift	15 KHz sine wave pitch shifted.
P28	100 Sq. Shift	100 Hz square wave pitch shifted.
P29	1K Sq. Shift	1 KHz square wave pitch shifted.
P30	15K Sq. Shift	15 KHz square wave pitch shifted.
P31	Sample Now!	Blank space to perform a sample test.
P32	Kick Drum	Play-test preset. Kick drum.
P33	Snare Drum	Play-test preset. Snare drum.
P34	High Hat	Play-test preset. High Hat
P35	Drum Kit	Play-test preset. Transient reponse test.
P36	Drum Beat	Play-test preset. Arpeggiator test.
P99	Emax II Test	Disk Title.

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POWER SUPPLY SPECIFICATIONS

POWER SUPPLY SPECIFICATIONS

Emax II uses a switching power supply which we do not consider to be field repairable. If a supply is defective, contact E-mu Customer Service at (408) 438-1921 between the hours of 9:00 am and 5:00 pm PST Monday through Friday to obtain a swap supply.

Note: Switching supplies will not operate without a load.

Green wire is **Digital Ground.**
Yellow wire is **+5 Volts** (4.75V - 5.25V).
Orange wire is **+12 Volts** (+11.4V - +12.6V).
Purple wire is **-12 Volts** (-11.4V - -12.6V).

Blue wire is **AC Neutral.**
Brown wire is **AC Hot.**
Green/Yellow wire is **AC Ground.**

■ *If +5 Volts is too low, it can cause the relay on the output board to chatter.*

■ Some Emax II's will have an auto-voltage-switching power supply, which automatically switches itself for 110 or 220 Volt operation. Other units have a standard supply which requires use of the 110/220 Volt selector on the back panel. make sure that the voltage selector is connected to the supply if necessary. See the assembly diagrams for proper connections.

■ There is one trimmer pot on the power supply board which simultaneously adjusts +5V and +12V.

■ The ±5 Volt supplies for the DACs are provided by separate regulators on the output board.

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AUDIO SPECIFICATIONS

EMAX II SPECIFICATIONS

MAX. OUTPUT LEVEL	+4 dB into 600Ω
INPUT IMPEDANCE	5 KΩ
OUTPUT IMPEDANCE	Stereo 100 KΩ Mono 2.5 KΩ Audio 600 Ω
DATA ENCODING	Input 16-bit linear Output 18-bit linear
SAMPLE RATE	39 KHz
SIGNAL TO NOISE	>90 dB
FREQ. RESPONSE	20 Hz - 19 KHz
THD + N	< .05%
STEREO PHASE	Phase Coherent ±1° @ 1 KHz
POWER USE	45 Watts

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TROUBLESHOOTING GUIDE

When troubleshooting Emax II, common sources of problems are connectors, ribbon cables, the LCD, and broken solder joints. The traces on the circuit boards are very thin. Be extremely careful when desoldering parts. If you are having problems desoldering a component, we suggest that you clip the part out rather than damaging the board. Once again, DO NOT attempt to remove and replace a surface-mounted IC. Damage to the board resulting from poor soldering is NOT covered under warranty. If you get stuck on a problem, please feel free to contact our Customer Service department at (408) 438-1921. They will be happy to assist you. Telephone support hours are between 9:00 am and 5:00 pm PST, Monday through Friday.

PROBLEM	CAUSE	SOLUTION
Computer		
No Lights, No power.	*Power supply bad, or bad power connector crimp.*	*Replace supply or repair connector.*
No boot. Power OK.	*Check front panel diagnostic LEDs. Do you get any LCD message?*	*Troubleshoot based on diagnostic LEDs. If HD, try floppy software.*
CPU Dead	*Check clock, data bus, etc. Does the CPU start to run? If so, suspect drive.*	*Troubleshoot to the basics. RD/WR, data bus, etc.*
Loads software, then display goes blank	*Bad scanner MPU.*	*Replace bad chip.*
Digital Distortion		
Bad distortion on one output.	*Bad DAC.*	*Replace bad chip.*
Low level on one output.	*Bad capacitor.*	*Replace capacitor.*
Single channel plays wrong pitch.	*LSI #1 bad.*	*Swap digital board.*
No output, single channel.	*Possible bad DAC, cap. or OpAmp.*	*Determine cause and replace bad component.*
Bad Sounds.	*Check LSI #1 for unsoldered pins.*	*Carefully resolder pins, or swap board.*

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PROBLEM	CAUSE	SOLUTION
Analog		
Noise (hiss) on single output.	*Possibly bad OpAmp or bad cap. on output filter.*	*Find and replace bad component.*
Hard Disk		
Hard disk doesn't work.	*HD may be damaged.*	*Try re-formatting HD or swap HD.*
Floppy Disk		
Intermittant or never loads disks.	*Drive may be out of alignment.*	*Have drive realigned or swap drive*
Intermittant loading.	*Possible wrong capacitor on power supply.*	*See E.C.O. section or call the factory.*
Keyboard		
Single key doesn't work.	*Dirty keyboard contact.*	*Carefully clean contact.*
Every eighth key doesn't work.	*Bad diode in keyboard matrix.*	*Replace bad diode.*
Other		
Chattering relay on audio outputs.	*Low +5 Volt supply or problem with IC24.*	*Adjust supply or correct malfunction.*
Slider doesn't work.	*Possibly broken solder joint at pot.*	*Resolder or replace pot.*
Slider or wheels don't work.	*Needs recalibration.*	*Recalibrate wheels and sliders.*
Squealing power supply.	*Bad decoupling capacitor.*	*Isolate to board, then find and replace shorted capacitor.*
Intermittant power.	*Bad connection at power supply.*	*Clean contacts and reseat power connector.*
Operator Error		
Pitch drifts and wavers out of tune.	*Controls need to be recalibrated.*	*Recalibrate controls (Master, Special, 3).*
MIDI Volume doesn't work.	*MIDI volume may not be assigned correctly.*	*See MIDI and Realtime Control instructions in chapter 1 of this book.*

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THEORY OF OPERATION

THEORY OF OPERATION

OVERVIEW

The Emax II is based on the software of the original Emax system which had a most extensive list of operational features. Using this mature and proven software has the additional benefit of making the Emax II a very reliable and bug-free instrument. Mush of the hardware in the Emax II is also similar to the original, especially the computer section. The sound generating sections are quite different.

The Emax II contains three circuit boards, the CPU board, the output board, and the front panel board. There is also a switching power supply which is not a field repairable item.

The simplified block diagram shows the entire Emax II. Looking at the center of the diagram, you can see that there are two CPU's in the Emax II. The scanner CPU handles most of the user interface. It "scans" the keyboard, front panel buttons, footswitches, sliders, wheels, and footpedal. The scanner interrupts the main CPU when it has data to transfer.

The main CPU handles everything else, including generation of the 32 envelopes and 16 LFOs. The Emax II operating system is loaded from disk, but the bootstrap program occupies two 2764 EPROMs. After being loaded from disk, the main operating system resides in four dynamic RAMs (either 4464s or 44256s). In the case of 4464 RAMs, and "overlay" system is used, since the operating system is too larger to fit into the available memory. The required portion of the operating system is loaded into RAM when a specific front panel module is accessed. This accounts for the slight delay when entering some modules on an Emax II without a hard disk.

There is also a EEPROM which contains important non-volatile information such as calibrations. The EEPROM is interfaced to the main CPU using a bizzare combination of the floppy side select, the MIDI off signal, a chip enable, and the MIDI interrupt lines.

The front panel LEDs are treated as a write-only port. They are connected to the output of a data latch which is written to by the main CPU when an LED is to be turned on or off.

The liquid crystal display is also connected to the data bus and is treated as a read/write port. All user information is written to this port in ASCII except for a few graphic symbols.

The floppy disk interface is handled by a Western Digital 1772 single chip floppy controller, which interfaces to the main CPU via the data bus.

The SCSI interface is handled by a 5380 SCSI interface chip which also interfaces to the main CPU via the data bus.

MIDI and the RS-422 interface are handled by a 6850 UART, together with a custom PAL (programmable logic array) and an 8254 programmable counter/timer.

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THEORY OF OPERATION

Looking now at the lower portion of the simplified block diagram, note that the sound RAM is completely isolated from the main CPU by the custom LSI chip #1. The LSI chips 1 and 2 handle all of the sound data manipulation functions. These functions include: low distortion pitch shifting for 32 channels of 16 bit audio data, digital low pass filtering with resonance (also 32 channels), amplitude contouring without digital "zippering", as well as channel summing and output channel assignments.

The sound RAM on the Emax II comes in two basic configurations from the factory. In the case of the standard Emax II with 1 Megabyte of sound RAM, the board comes with (32) 4464 (64K x 4) dynamic RAMs. In the case of a 4 Meg "Turbo" unit, the CPU board contains (16) 44256 (256K x 4) dynamic RAMs and has an expansion board attached containing 16 more 44256's. The 4464 RAMs are used on the standard model to reduce the initial price of the unit. RAM memory may be added in 2 Megabyte installments (via an expansion board) up to a maximum of 7 Megabytes for a standard Emax II or 8 Megabytes for the Turbo model.

The output section consists of eight 18 bit DACs which are connected via a serial interface to custom LSI chip #2. These DACs have glitch-free outputs and therefore do not require a sample and hold circuit. Each DAC is followed by a low-pass filter which removes all audible artifacts of the D/A conversion process.

The upper left corner of the simplified block diagram shows the sampling circuitry. The Emax II can be either a mono or stereo sampler, depending on whether a mono or stereo A/D converter is installed. The gain of the input signals are controlled by 7524 multiplying DACs, and in the case of a mono sampling Emax II, fed through an anti-alias filter constructed from 5532 op-amps. Stereo Emax II's do not require the anti-alias filter since this is handled by the stereo ADC itself.

NOTICE

Emax II was designed to use 74HCT series logic instead of 74LS. This was done in order to lower the power requirements and use a smaller power supply. We do NOT recommend using 74LS chips as replacements for HCT as they overtax the power supply. There are a few locations where "S" parts are used because of circuit loading, however the majority of TTL ICs are HCT.

MAIN CPU

The Emax II CPU is a National 32CG16, 16 bit bus processor with 32 bit internal processing. The 32CG16 produces a 24 bit address, latching the low order 16 bits from the multiplexed address/data bus using two 74HCT373's. The low order byte of the data bus is buffered to the output board by a 74HCT245. The CPU obtains -INT and -CWAIT from the interrupt/wait control PAL (IC10) and -WAIT1 and -WAIT2 from the chip select PAL. The 20MHz CPU clock is generated inside the 32CG16 with an external

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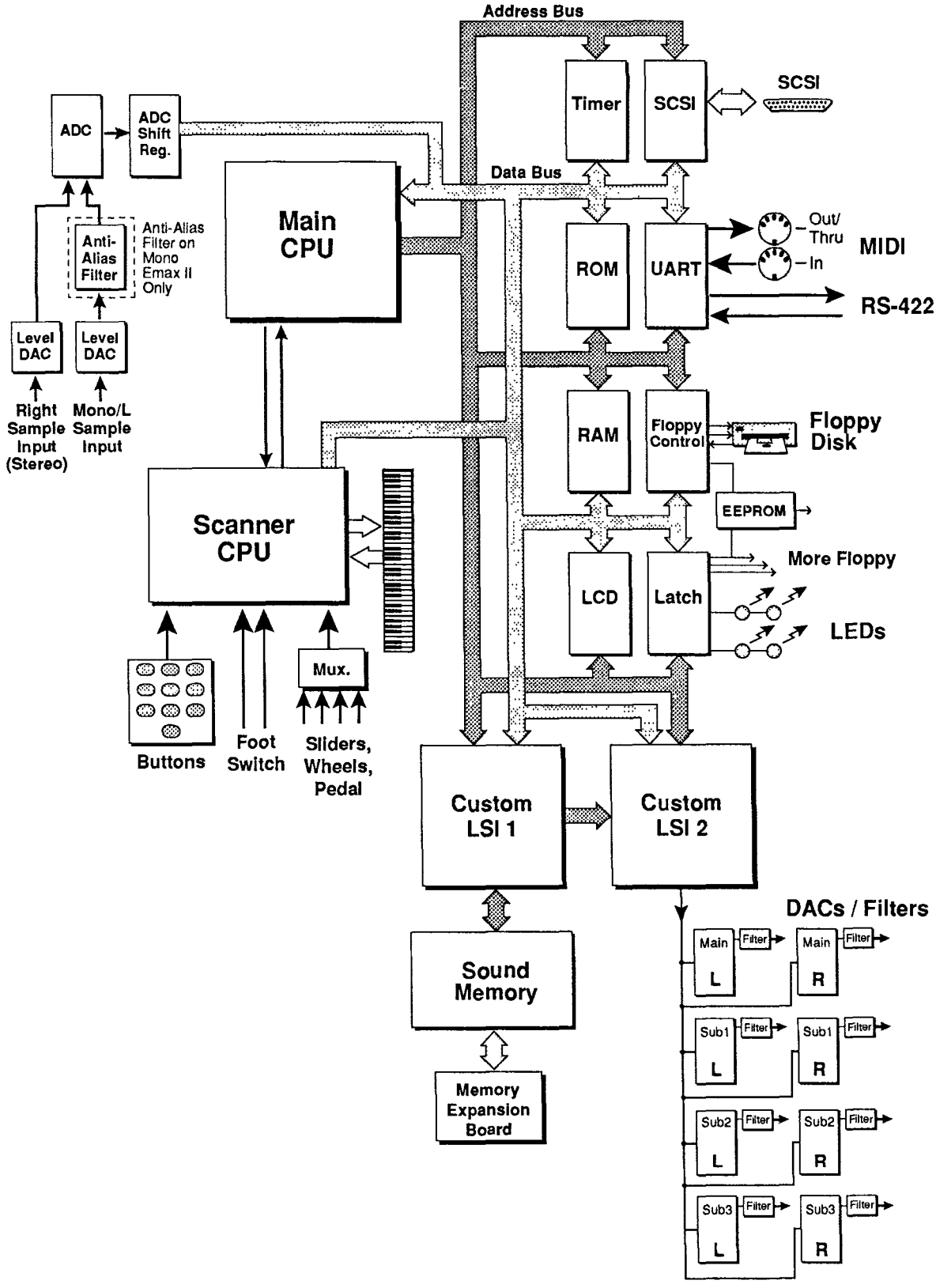
EMAX II SIMPLIFIED BLOCK DIAGRAM



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THEORY OF OPERATION

crystal and a few other components. The reset circuitry is also internal to the 32CG16 with the exception of a capacitor, resistor and diode.

The "wait state" timing of the 32CG16 is controlled by the address bus of the 32CG16 via a PAL (IC14). Hence the port address of memory and I/O will declare their timing through the states of -WAIT1 and -WAIT2. Wait states may be invoked by the ADC, the LSI chips, or the main processor DRAM which communicates to the CPU via the interrupt/wait PAL.

PROCESSOR DRAM

The processor DRAM consists of either 64K x 16 bits (or 256 x 16 bit if 44256s are installed) of DRAM controller by a PAL (IC26) with an address mux. The PAL selects the start of a cycle from the address strobe (-ADS.D), and initiates a RAS-AMUX-CAS cycle as a consequence. The wait line from the PAL will always go low during refresh, however, the INT/WAIT PAL will only cause a CPU CWAIT when a new bus cycle is begun.

BOOT EPROM, 8254 TIMER

The boot EPROMs are two 2764's. These supply 16 Kbytes, configured as 8K x 16 of boot RAOM ending just below the start of DRAM.

The 8254 timer produces two signals:

■ The Transient Generator interrupt (-TGTIME) is a periodic interrupt produced from a divisor on the 8 MHz clock, The TG interrupt is so named because it signals the CPU that it is time for a TG update cycle.

■ The -SWTIME signal (divided from the 500 KHz clock) is a general purpose software interrupt timer. This controls functions such as sequencer and arpeggiator timing. The -SWTIME signal is supplied to a PAL which selects between the internal software timer or an external clock.

■ The third section (CK0) of the 8254 is unused.

CHIP SELECTS AND INTERRUPTS

The chip selects are produced through the use of a PAL and two 74HCT138's. The PAL decodes the addresses and the bus control signals to produce enables for the 138's. The PAL generates the -WAIT1 and -WAIT2 signals as well as the bi-directional data buffer enable signals. The -WAIT1 and -WAIT2 signals are address dependent. Hence the programmer can generally adjust device timing and which side of the bi-directional data buffer is being used.

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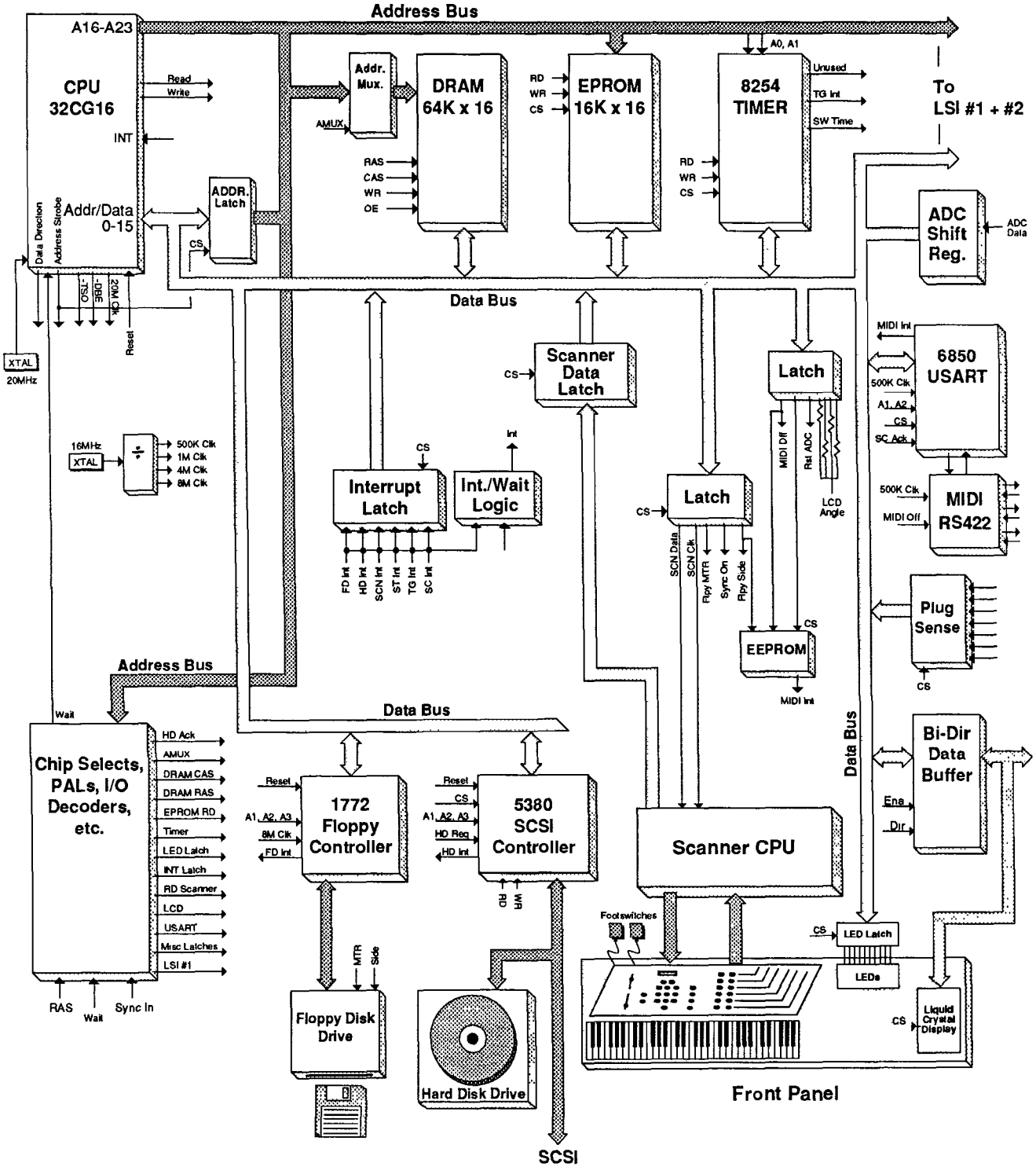
EMAX II CPU SECTION



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THEORY OF OPERATION

The interrupt vector is supplied to the CPU by directly reading the various interrupt lines. The programmer assembles a prioritized vector table for all of the possibilities. The interrupt/wait PAL combines the various sources of WAIT and INT signals to produce CWAIT and INT. This PAL also contains the logic associated with 5380 SCSI controller handshake.

SCANNER MPU

The scanner MPU is the Rockwell 6500/11 processor which reads the keyboard, footswitches, footpedal, panel pots, and panel switches. This is a custom masked, single chip microcomputer containing its own ROM, RAM, counter/timers, I/O ports and clock. It is the same scanner chip used in the original Emax and EIII.

The scanner MPU handles the velocity-sensing keyboard and the front panel pushbutton interfacing with associated 4028 decoders and a 74HCT244 bus driver. The keyboard and buttons are arranged in a standard diode matrix.

To perform an analog to digital conversion, the 6500 first selects X7 on the 4051 multiplexer. This line is connected to +5 volts and so charges capacitor C9. Next, the pot to be measured is selected, and an internal counter is started. Since the pot is now essentially across the capacitor to ground, the capacitor begins to discharge. When the voltage across the capacitor drops below the threshold of the digital inverter, the output of the inverter goes high and is sensed by an input line of the 6500 which stops the counter. The count directly corresponds to the position of the pot.

The communication between the 6500 and the 32CG16 microprocessors is handled in the following manner: When the 6500 has data for the 32CG16, it requests a SCNINT interrupt. When the 32CG16 honors this interrupt by reading the CSSCAN port with SCNDATA and SCNCLK bits low, the 6500 receives an NMI, allowing it to pass additional data if required. When the 32CG16 wishes to send data to the 6500, it issues a CSSCAN with either (or both, depending on the data to be transferred) of the SCNDATA and SCNCLK lines held high. The 6500 reacts to this NMI by either performing the requested operation or entering a serial transfer mode whereby the 32CG16 sends data using the SCDATA or SCNCLK lines to the 6500. The data and clock lines are part of the parallel latch, IC35.

FLOPPY DISK

The floppy disk controller is based on the Western Digital 1772 single chip floppy controller. This chip supplies most of the floppy disk control signals and directly interfaces to the main CPU. It's interrupt is routed through the interrupt PAL (IC10) which generates an -INT to the CPU.

The floppy disk input signals are terminated by R-pack networks, and the output signals are driven by inverting drivers. Two additional signals, side select and motor control, are driven by an external latch because they are not correctly supplied by the 1772.

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THEORY OF OPERATION

HARD DISK and SCSI

The hard disk is accessed via SCSI, a high speed bus. The internal hard disk (if any) being one 8 possible devices on the parallel SCSI bus. The NCR 5380 SCSI interface chip is accessed directly by the main CPU. This chip handles all the SCSI protocol and driving requirements. Each byte of data from the 5380 is simultaneously placed on both low and high order data lines (by IC27) in order to facilitate fast transfer into the CPU.

MIDI and RS-422 INTERFACE

Both MIDI and the RS-422 serial interface are handled by the 6850 UART chip. MIDI is transmitted and received by familiar interface electronics. A PC900 opto-isolator is used for input isolation and an output driver in the serial PAL is employed for MIDI transmission. Similarly, the RS-422 drivers and receivers are standard and familiar. The PAL selects between MIDI and RS-422 operation depending on the state of the -MIDIOF bit. MIDI OFF causes the serial RXD to come from the RS-422 receiver and the serial TXD to go to the RS-422 driver while MIDI remains inactive. MIDI ON deactivates the RS-422 drivers and instead gets RXD from the MIDI opto-isolator and sends TXD to the MIDI driver.

MISCELLANEOUS

Three 74HCT273 data latches hold the miscellaneous bits for the system. One latch (IC34) is dedicated exclusively to the LEDs. Two LEDs are also driven by a second data latch (IC35). Additional bits include:

-MTR	Floppy Disk Motor	IC35
-SIDE	Floppy Side Select	IC35
SYNC OUT	Square Wave Clock Out	IC35
+SYNC/-TIME	Internal/External Sequencer Sync	IC35
+SCNCLK	Serial Clock to Scanner Processor	IC35
+SCNDATA	Serial Data to Scanner Processor	IC35
+EECE	EEPROM Chip Enable	IC36
-MIDIOF	MIDI/RS-422 Select	IC36
+RSTADC	Reset ADC Control Counter	IC36

The remaining four bits of IC36 feed a R/2R resistor ladder to form a cheap DAC, the output of which is used to adjust the LCD viewing angle on keyboard models only. LCD angle is adjusted using a front panel mounted potentiometer on rack mount Emax II's.

SOUND GENERATING SECTION

Emax II incorporates 8 polyphonic audio outputs. Two of the jacks serve as left and right Main outputs and the remaining three pairs are designated as Submix 1, Submix 2, and Submix 3 outputs. Additionally, there are also dedicated jacks for stereo headphones and a mono output mix (sum of the left and right main outputs).

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THEORY OF OPERATION

The outputs are all protected from power on/off pops by a time delayed relay. The relay and associated timer (IC24) delay the ±12V power to the op-amps on the power-up cycle until +5 volts becomes stable. On power-down, the ±12V supplies are instantly switched off.

The submix outputs all have "plug sensing", which tells the microprocessor which jacks have plugs inserted. This is done so that all presets can be heard even if they have been routed to one of the submix outs. If nothing is plugged into a submix jack, the submix routing is ignored and the preset is routed instead to the main outputs. The CPU determines the status of the submix jacks by reading the input port at location IC22.

The rings of the stereo jacks serve as submix returns which sum the signal back into the main outputs. This allows the user to process certain presets and return them to the main mix without using up channels of the mixing board.

The outputs are each driven by a 5532 low-noise op-amp running on the ±12V supplies (the main outs use an additional 5532 to sum the submix returns). These op-amps also serve as part of the 3-pole (.5 dB Chebeshev) reconstruction filter. The purpose of the reconstruction filter, as you probably already know, is to remove the "stairsteps" in the signal which are generated as a result of the D/A conversion process.

The D/A converters are 18-bit linear DACs which do not require a sample/hold deglitcher on their output. The 18-bit DACs run on their own ±5 volt analog power, supplied by VR1 and VR2 (7805 and 7905 regulators). The DACs also have a serial input which is generated by the LSI #2 chip. In fact, LSI #2 (IC367) generates all the control signals for the DACs.

SAMPLING CIRCUITS

The sample input on the Emax II is a stereo jack. The tip of the jack corresponds to the left input and the ring corresponds to the right input. The signal to be sampled is coupled through a 10µF capacitor and then applied through a level scaling circuit consisting of a 5532 and 7524 DAC. The DAC is used as a programmable feedback resistor on the 5532 to control the amount of gain. The circuit is identical for both channels.

In the case of an Emax II with mono sampling capabilities only, the signal now passes through the anti-alias lowpass filter (3-pole elliptical) constructed from 5532 op-amps. The anti-alias filter removes any frequencies above 60 KHz. The filtered signal is now applied to the A/D converter in location IC9, which oversamples at a 78 KHz rate. Frequencies above 18 KHz are removed using digital filtering techniques.

In the case of an Emax II with stereo sampling capabilities, a stereo ADC is located in IC10 and the mono ADC in location IC9 is not installed. An anti-alias filter is not required when the stereo ADC is is used because the ADC chip oversamples the signal by 64x, then employes DSP filtering.

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THEORY OF OPERATION

The digital sound data from the ADC chip is transferred serially to a 16-bit (serial in/parallel out) shift register (ICs 54, 55). The ADC and shift register are synchronized using the ADC clock signals supplied by the Serial PAL (IC25). The clock signals *into* the Serial PAL are supplied by divider IC91. The ADC is constantly sampling, but is only read by the CPU when in sample mode. A-CWAIT is generated by the Wait PAL when it receives the ADC chip select and the ADC wait signal simultaneously, which signals the CPU to read the ADC port.

It may be of interest to know that although the Emax II has several sample rates (20 KHz, 22 KHz, 27 KHz, 31 KHz, 39 KHz), the ADC chip always samples at its highest rate. The lower sample rates are calculated from the 39K rate using DSP methods to even further refine the A/D conversion.

POWER SUPPLY

The switching power supply generates +5 volts and ±12 volts. +5V is used by the digital section and the ±12V powers the op-amps. The ±12V lines are further regulated down to ±5V for use by the DACs and the ADC. This provides isolation from the digital +5V supply. We consider the switching power supply to be non-field repairable. If it's bad, swap it.

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SIGNAL NAME DEFINITIONS

SIGNAL NAME DEFINITIONS

The signal names are comprised of:
(a) + or - specifying active high or low.
(b) An abbreviation of the signal function.
(c) An abbreviation of the signal type.
(d) The signal's destination and source page numbers. Source page is indicated by an + following the page number. If there is no + after a page number then the present page is the source page. If the present page is listed with the destination page then the signal appears again on the same page.
There are three types of signals; D, V and I. D stands for digital, V stands for voltage or an analog signal and I stands for a current.

EIII Signal Name List

Name	Source	Destination	Type	Description
+A0.D	CPU 1	CPU 4	TTL	Main CPU Addr. Bus 0
+A1.D	CPU 1	CPU 3, 4, 6, 7, 9, 11, 12	TTL	Main CPU Addr. Bus 1
+A2.D	CPU 1	CPU 3, 4, 6, 7, 9, 11, 12	TTL	Main CPU Addr. Bus 2
+A3.D	CPU 1	CPU 3, 4, 6, 7, 11, 12	TTL	Main CPU Addr. Bus 3
+A4.D	CPU 1	CPU 3, 4, 6, 11, 12	TTL	Main CPU Addr. Bus 4
+A5.D	CPU 1	CPU 3, 4, 6, 11, 12	TTL	Main CPU Addr. Bus 5
+A6.D	CPU 1	CPU 3, 4, 11, 12	TTL	Main CPU Addr. Bus 6
+A7.D	CPU 1	CPU 3, 4, 11, 12	TTL	Main CPU Addr. Bus 7
+A8.D	CPU 1	CPU 3, 4, 11, 12	TTL	Main CPU Addr. Bus 8
+A9.D	CPU 1	CPU 3, 4, 11, 12	TTL	Main CPU Addr. Bus 9
+A10.D	CPU 1	CPU 3, 4, 11, 12	TTL	Main CPU Addr. Bus 10
+A11.D	CPU 1	CPU 3, 4, 12	TTL	Main CPU Addr. Bus 11
+A12.D	CPU 1	CPU 3, 4, 12	TTL	Main CPU Addr. Bus 12
+A13.D	CPU 1	CPU 2, 3, 4, 12	TTL	Main CPU Addr. Bus 13
+A14.D	CPU 1	CPU 3, 4	TTL	Main CPU Addr. Bus 14
+A15.D	CPU 1	CPU 2, 4	TTL	Main CPU Addr. Bus 15
+A16.D	CPU 1	CPU 2, 4	TTL	Main CPU Addr. Bus 16
+A17.D	CPU 1	CPU 2, 4	TTL	Main CPU Addr. Bus 17
+A18.D	CPU 1	CPU 2, 4	TTL	Main CPU Addr. Bus 18
+A19.D	CPU 1	CPU 2	TTL	Main CPU Addr. Bus 19
+A20.D	CPU 1	CPU 2	TTL	Main CPU Addr. Bus 20
+A21.D	CPU 1	CPU 2	TTL	Main CPU Addr. Bus 21
+A22.D	CPU 1	CPU 2	TTL	Main CPU Addr. Bus 22
+A23.D	CPU 1	CPU 2, 4	TTL	Main CPU Addr. Bus 23
+ADCCLK.D	CPU 6	CPU	TTL	ADC Clock
+ADCDTA.D	OUT	CPU 10	TTL	ADC Data

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SIGNAL NAME DEFINITIONS

Name	Source	Destination	Type	Description
+ADCWAIT.D	CPU 10	CPU 2	TTL	ADC Wait
-ADS.D	CPU 1	CPU 4	TTL	Address Strobe
AGND	OUT	OUT	GND	Analog Ground
+BD0.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 0
+BD1.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 1
+BD2.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 2
+BD3.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 3
+BD4.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 4
+BD5.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 5
+BD6.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 6
+BD7.D	CPU 2	CPU 6, 9, OUT 1, 3	3-State	Buffered Data Bus 8
+C500K.D	CPU 4	CPU 6	TTL	500 KHz Clock
+C1M.D	CPU 4	CPU 4	TTL	1 MHz Clock
+C4M.D	CPU 4	CPU 8	TTL	4 MHz Clock
+C8M.D	CPU 4	CPU 3, 6	TTL	8 MHz Clock
+C16M.D	CPU 4	CPU	TTL	16 MHz Clock
+C20M.D	CPU 1	CPU 10, 11, 12,17	TTL	20 MHz Clock
-CAS.D	CPU 14	CPU 5	TTL	CPU RAM CAS
-CSADC.D	CPU 2	CPU 10	TTL	Read ADC Chip Select
-CSDRAM.D	CPU 2	CPU 4	TTL	DRAM Chip Select
-CSFDC.D	CPU 2	CPU 3	TTL	Floppy Control CS
-CSHDC.D	CPU 2	CPU 7	TTL	HD Control CS
-CSHDD.D	CPU 2	CPU 2	TTL	HD Drive CS
-CSJACK.D	CPU 2	CPU 9, OUT 3	TTL	Jack Sense CS
-CSROM.D	CPU 2	CPU 3	TTL	ROM CS
-CSRSCN.D	CPU 2	CPU 8	TTL	Read Scanner CS
-CSTIMR.D	CPU 2	CPU 6	TTL	Timer CS
-CSWEWE	CPU 2	CPU 6	TTL	Misc. Chip Select
-CSWLEDA.D	CPU 2	CPU 9	TTL	Write A LEDs CS
-CSWLEDB.D	CPU 2	CPU 9	TTL	Write B LEDs CS
-CSWGAIN.D	CPU 2	CPU 9, OUT 1	TTL	Write Gain DAC CS
+CTR1M.D	CPU	CPU 6	TTL	1 MHz ADC Clock
+CTR5M.D	CPU	CPU 6	TTL	5 MHz ADC Clock
+CTR40K.D	CPU	CPU 6	TTL	40KHz ADC Clock
+CTRCLK.D	CPU 6	CPU 10	TTL	10M ADC Count Clock
+CTTL.D	CPU 1	CPU 4, 6	TTL	10MHz Clock
-CWAIT.D	CPU 2	CPU 1	TTL	Continuous Wait

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SIGNAL NAME DEFINITIONS

Name	Source	Destination	Type	Description
+D0.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 0
+D1.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 1
+D2.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 2
+D3.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 3
+D4.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 4
+D5.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 5
+D6.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 6
+D7.D	CPU 2	CPU 2, 3, 5, 6, 7, 8, 10, 11, 12	3-State	Main CPU Data Bus 7
+D8.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 8
+D9.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 9
+D10.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 10
+D11.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 11
+D12.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 12
+D13.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 13
+D14.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 14
+D15.D	CPU 2	CPU 3, 5, 10, 11, 12	3-State	Main CPU Data Bus 15
-DBE.D	CPU 1	CPU 2	TTL	Data Buffer Enable
DGND	CPU	CPU	GND	Digital Ground
-DIR.D	CPU 3	Floppy Disk	TTL	Floppy Head Direction
+E68XX	CPU 2	CPU 6	TTL	USART Enable
+EECE.D	CPU 6	CPU 9	TTL	EEPROM Chip Enable
+ELCD.D	CPU 2	CPU 9, Frnt Pnl	TTL	LCD Enable
+FDCINT.D	CPU 3	CPU 2	TTL	Floppy Controller Int.
+FCLK.D	CPU 1	CPU 2, 4	TTL	Fast Clock
+FDCREQ.D	CPU	CPU	TTL	Floppy Control Request
+FILT.V	OUT 4	OUT 4	Volt.	Anti-Alias Filter Output
-HBE.D	CPU 1	CPU 4	TTL	High Byte Enable
-HDACK.D	CPU 2	CPU 7	TTL	Hard Disk Acknowl.
+HDINT.D	CPU 7	CPU 2	TTL	Hard Disk Interrupt
+HDREQ.D	CPU 2	CPU 7	TTL	Hard Disk Request

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SIGNAL NAME DEFINITIONS

Name	Source	Destination	Type	Description
-HWE.D	CPU 2	CPU 3	TTL	High RAM Write Ena.
-IDX.D	Floppy	CPU 3	TTL	Floppy Disk Index
-INT.D	CPU 2	CPU 1	TTL	CPU Maskable Int.
-INTVEC.D	CPU 2	CPU 2	TTL	Read Int. Vector Port
+LFTRGT.D	CPU 6	OUT 4	TTL	L/R Sample Select
+LIN.V	OUT 1	OUT 3, 4	Volt.	Left Ch. Sample Input
-LWE.D	CPU 4	CPU 5	TTL	Low RAM Write Enable
+MAINL.V	OUT 1	OUT 3	Volt.	Left Main Output
+MAINR.V	OUT 1	OUT 3	Volt.	Right Main Output
-MIDINT.D	CPU 8	CPU 2	TTL	MIDI Interrupt
-MIDIOF.D	CPU 6	CPU 6, 9	TTL	MIDI Off
-MTR.D	CPU 9	CPU 3	TTL	Floppy Motor Control
-NMI.D	CPU	CPU 1	TTL	Non-Maskable Int.
-PULDN1.V	CPU 4	CPU 2	Volt.	Pull Down 1 (test)
-PULDN2.V	CPU 4	CPU 6	Volt.	Pull Down 2 (test)
+RA0.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 0
+RA1.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 1
+RA2.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 2
+RA3.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 3
+RA4.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 4
+RA5.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 5
+RA6.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 6
+RA7.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 7
+RA8.D	CPU 4	CPU 5	TTL	CPU RAM Row Addr 8
-RAMOE.D	CPU 4	CPU 5	TTL	CPU RAM Output Ena.
-RAS.D	CPU 4	CPU 5	TTL	CPU Row Addr. Strobe
-RD.D	CPU 1	CPU 2, 3, 4, 6, 7, 10	TTL	Main CPU Read Line
-RDTA.D	Floppy	CPU 3	TTL	Floppy Read Data
-RESET.D	CPU 1	CPU 3, 6, 7, 8, 9, 11, 12	TTL	Main Reset
+RIN.V	OUT 1	OUT 3	Volt.	Right Ch. Sample Input
+RSTADC.D	CPU 6	CPU 10	TTL	Reset ADC Shift Regis.
-RSTINT.D	CPU 2	CPU 4	TTL	Reset Interrupts
-RWAIT.D	CPU 4	CPU 2	TTL	Reset Waits
-SCANACK.D	CPU 2	CPU 8	TTL	Scanner Acknowledge
-SCNCLK.D	CPU 9	CPU 8	TTL	Scanner Data Clock
-SCNDTA.D	CPU 9	CPU 8	TTL	Scanner Init. Data
-SCNINT.D	CPU 8	CPU 2	TTL	Scanner Interrupt
-SIDE.D	CPU 9	3, 9, Floppy	TTL	Floppy Side Select
+SMAL.V	OUT 2	OUT 3	Volt.	Submix A - L Channel
+SMAR.V	OUT 2	OUT 3	Volt.	Submix A - R Channel
+SMBL.V	OUT 2	OUT 3	Volt.	Submix B - L Channel
+SMBR.V	OUT 2	OUT 3	Volt.	Submix B - R Channel
+SMCL.V	OUT 2	OUT 3	Volt.	Submix C - L Channel
+SMCL.V	OUT 2	OUT 3	Volt.	Submix C - R Channel

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SIGNAL NAME DEFINITIONS

Name	Source	Destination	Type	Description
+SRCD.D	CPU 11	CPU 12	TTL	Serial Channel Data
-STEP.D	CPU 3	Floppy	TTL	Floppy Head Step
-STINT.D	CPU 4	CPU 2	TTL	Software Timer Int.
+SYNC/-TIME	CPU 9	CPU 4	TTL	External Synch On/Off
-SWTIME.D	CPU 6	CPU 4	TTL	Software Timer
-TGINT.D	CPU	CPU 2	TTL	Transient Generator Int.
-TGSTINT.D	CPU 4	CPU 2	TTL	T.G. /Softw. Timer Int.
-TGTIME.D	CPU 6	CPU 4	TTL	T.G. Timer
-TK0.D	Floppy	CPU 3	TTL	Track 0
-TSO.D	CPU 1	CPU 2	TTL	Fast Read or Write
-WAIT1.D	CPU 1	CPU 2	TTL	Add 1 Wait State
-WAIT2.D	CPU 1	CPU 2	TTL	Add 2 Wait States
-WDTA.D	CPU 3	Floppy	TTL	Floppy Write Data
-WG.D	CPU 3	Floppy	TTL	Floppy Write Gate
-WP.D	Floppy	CPU 3	TTL	Floppy Write Protect
-WR.D	CPU 1	CPU 4, 6, 7	TTL	Main CPU Write Line

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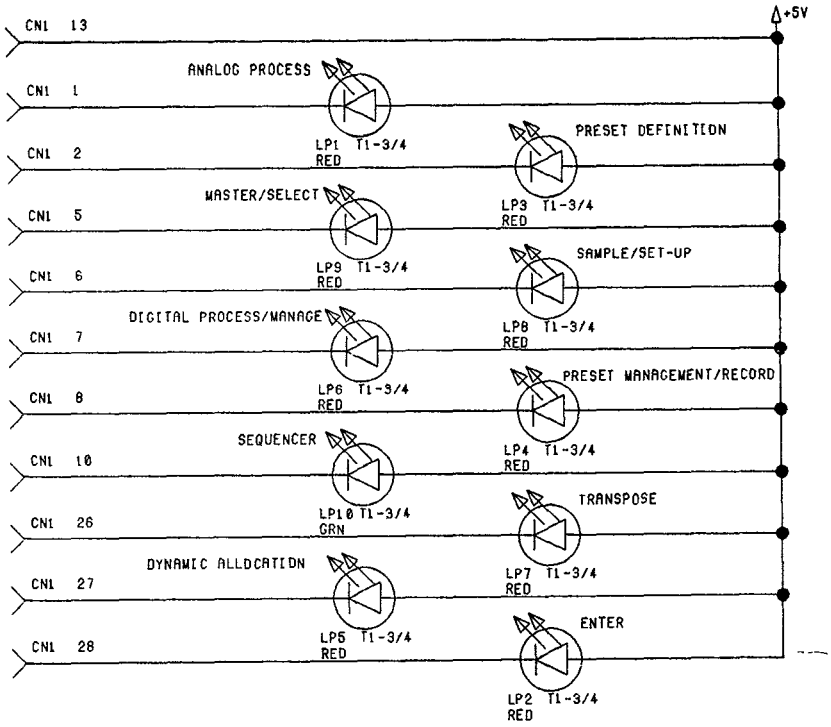
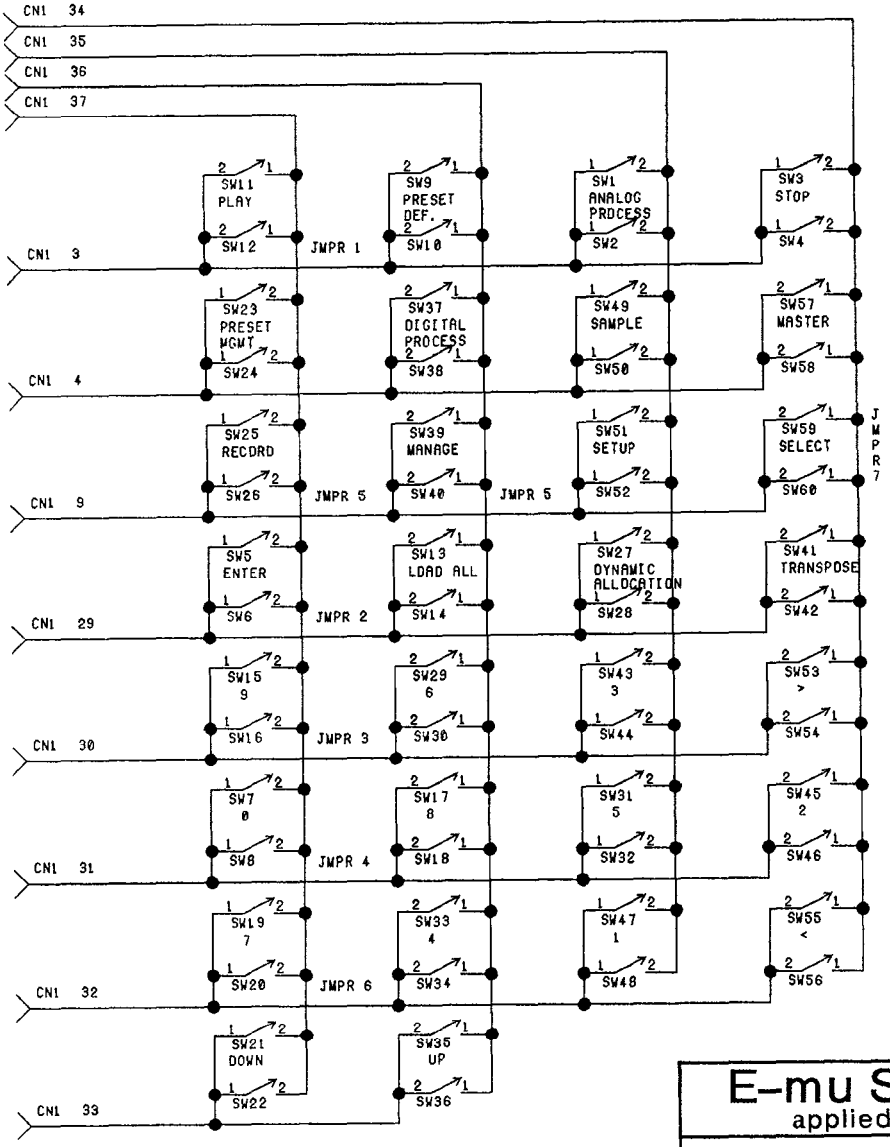
SCHEMATIC DIAGRAMS





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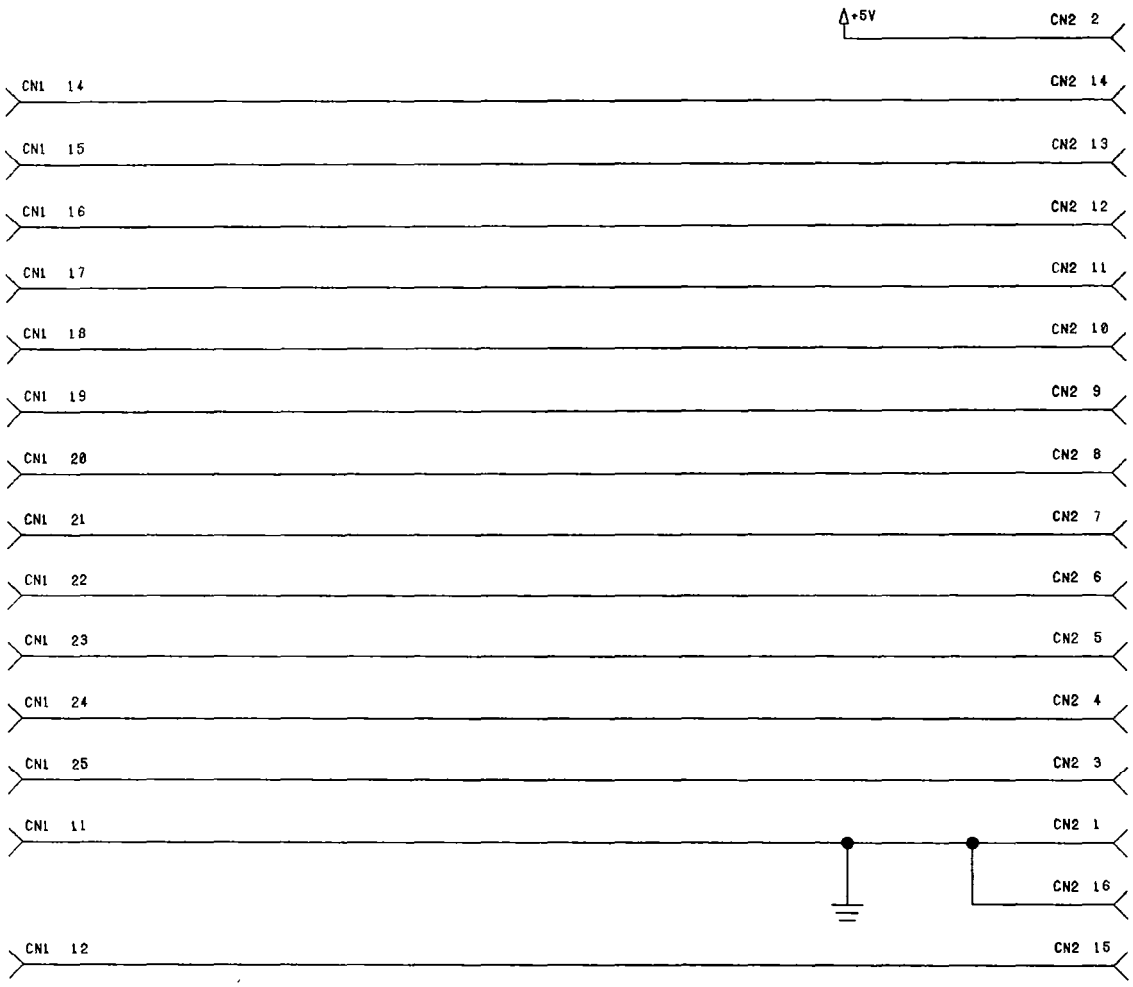
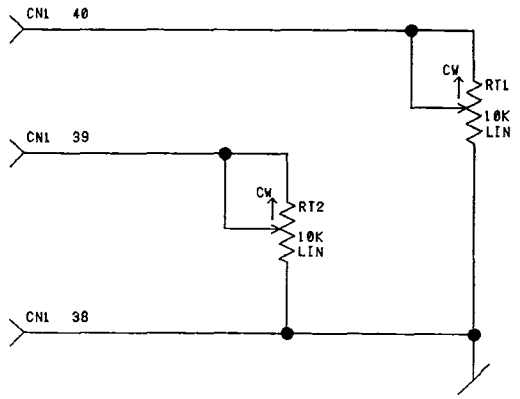
EMAX FRONT PANEL VERSION 1 PCB SCHEMATIC

DRAWN BY: D.R.	DOC.#: S-7607111 PAGE 1 OF 2
REV B	DATE 860928





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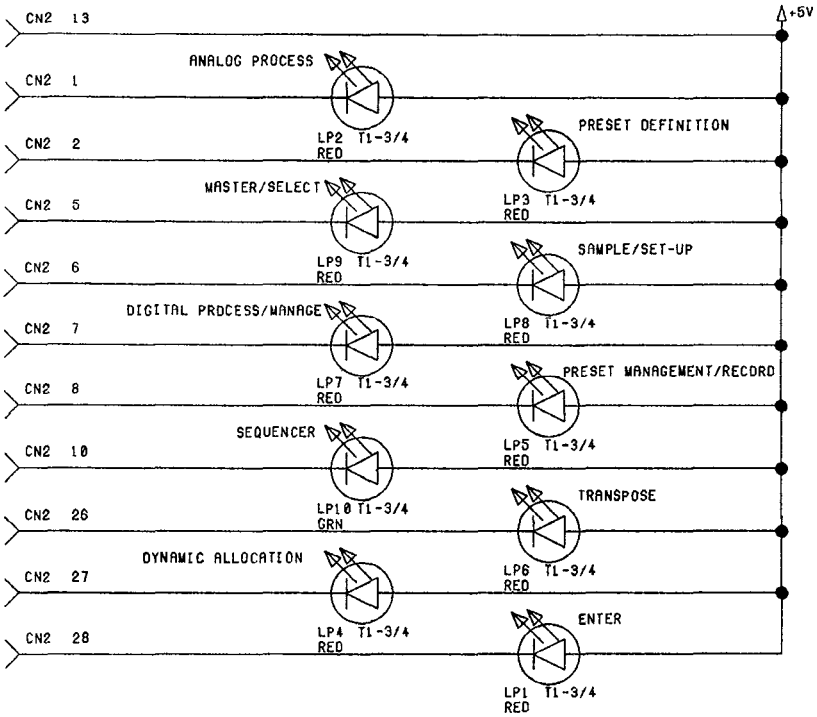
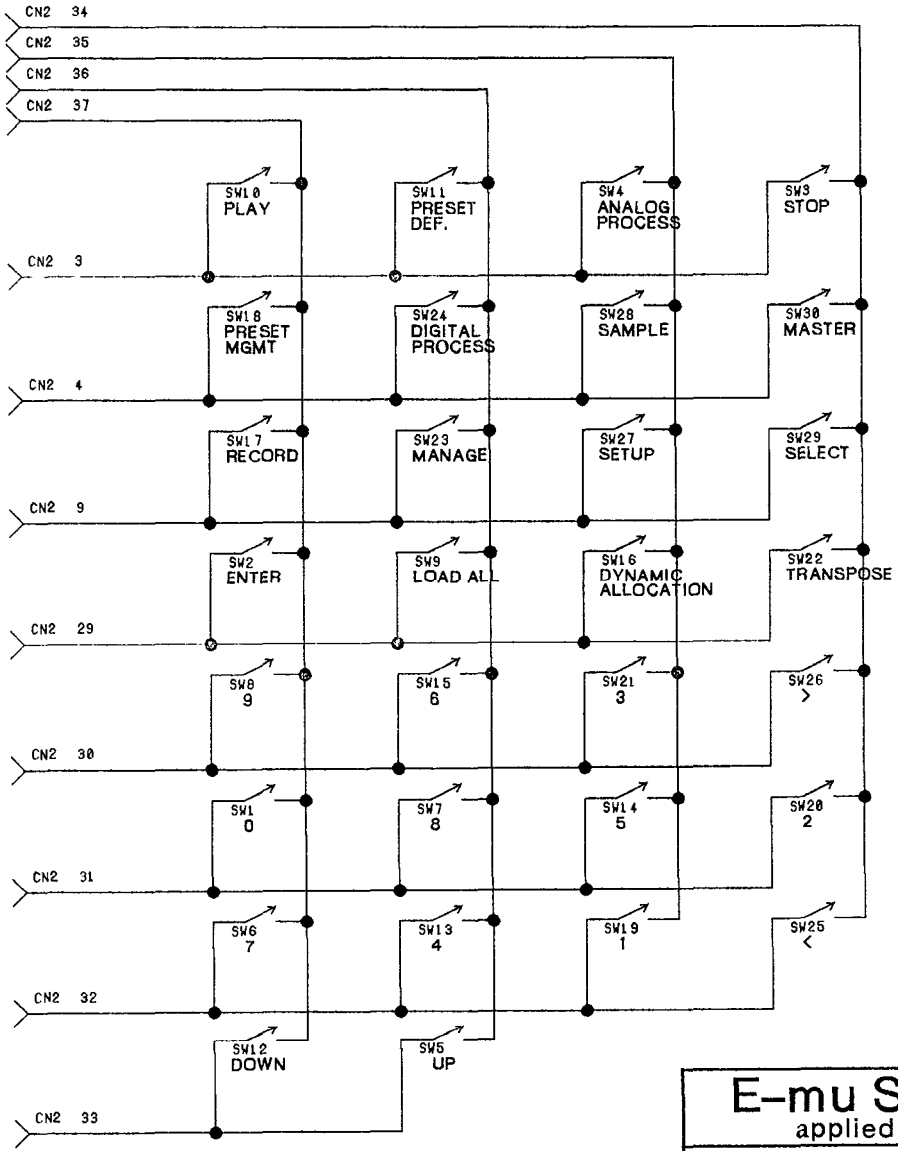
EMAX FRONT PANEL SCHEMATIC	
DOC. #: S-7607111 PAGE 2 OF 2	





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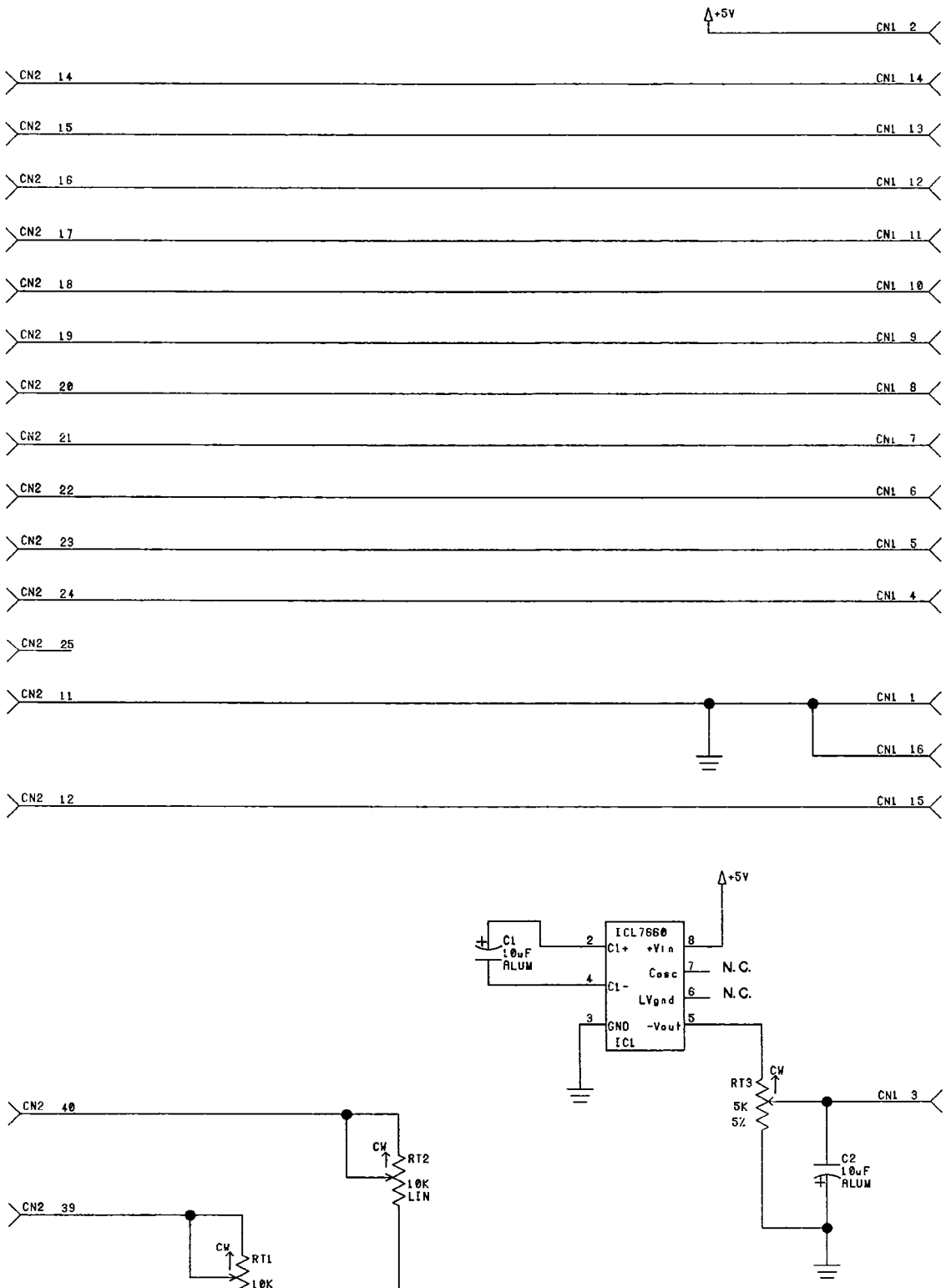
DRAWN BY: W.S.	DOC #: S-7607132	
REV A	DATE 861119	PAGE 1 OF 2



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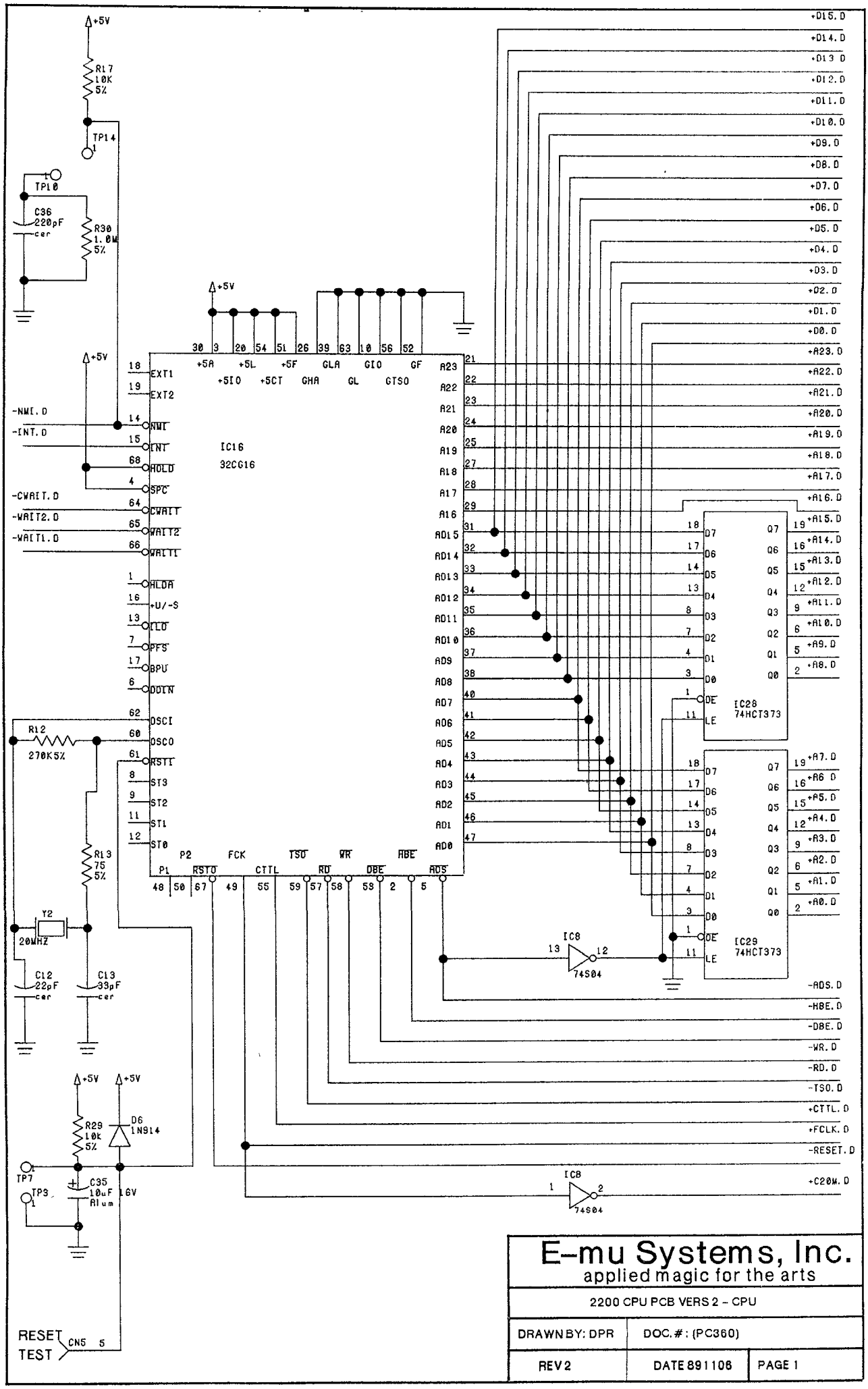
EMAX RACK FRONT PANEL VERSION 2	
	PAGE 2 OF 2



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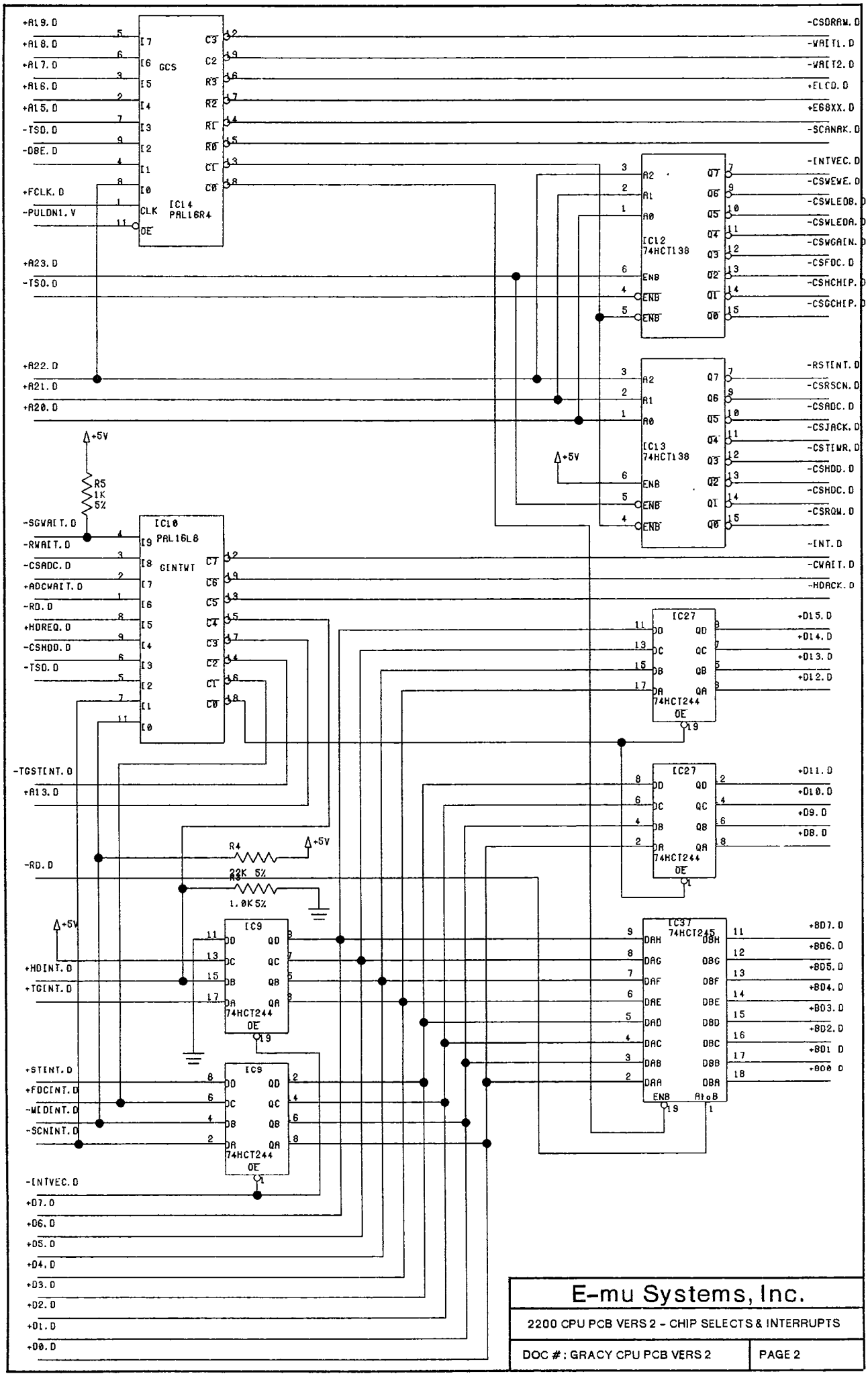
2200 CPU PCB VERS 2 - CPU		
DRAWN BY: DPR	DOC.#: (PC360)	
REV 2	DATE 891106	PAGE 1



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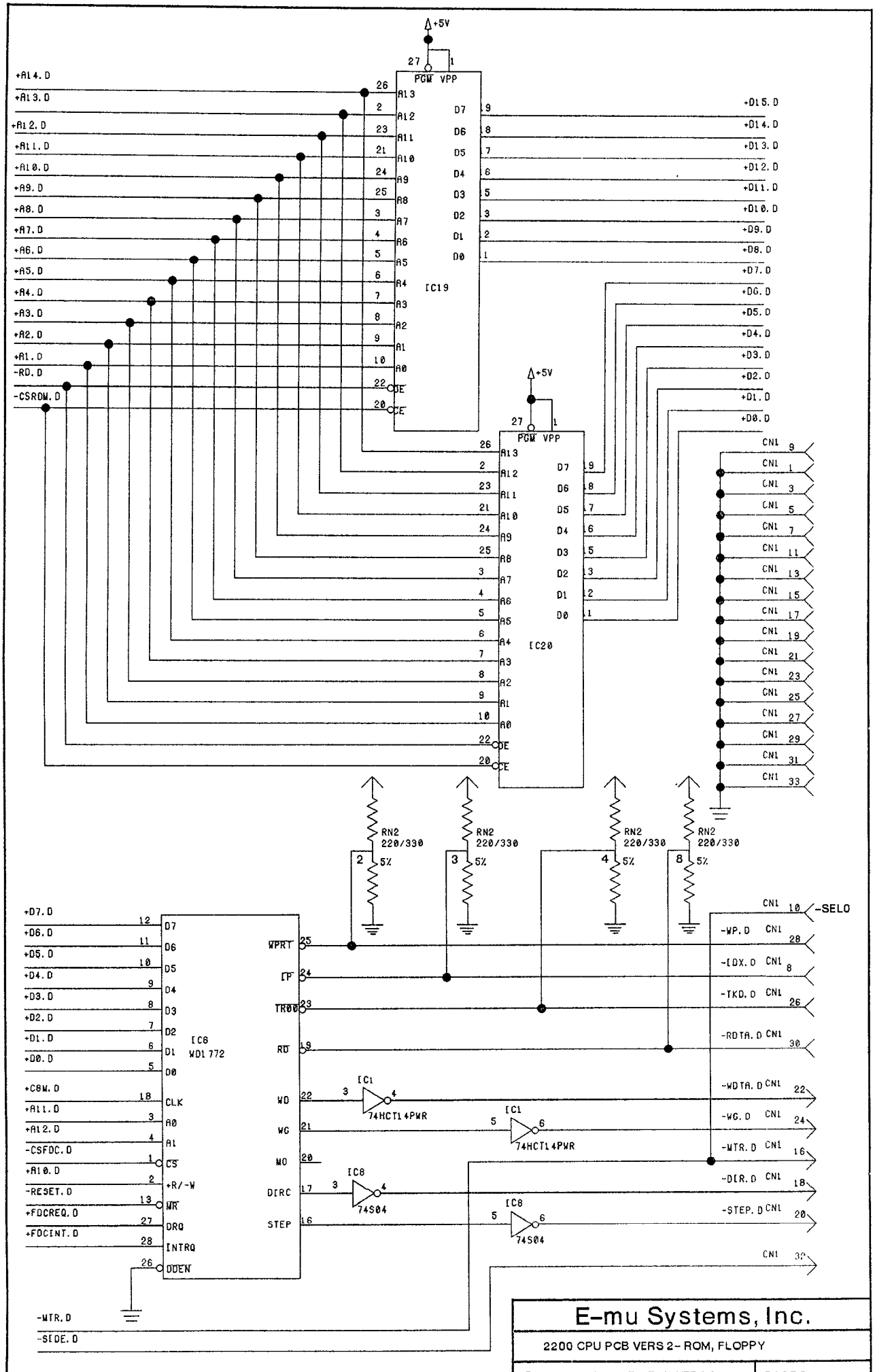
2200 CPU PCB VERS 2 - CHIP SELECTS & INTERRUPTS	
DOC # : GRACY CPU PCB VERS 2	PAGE 2



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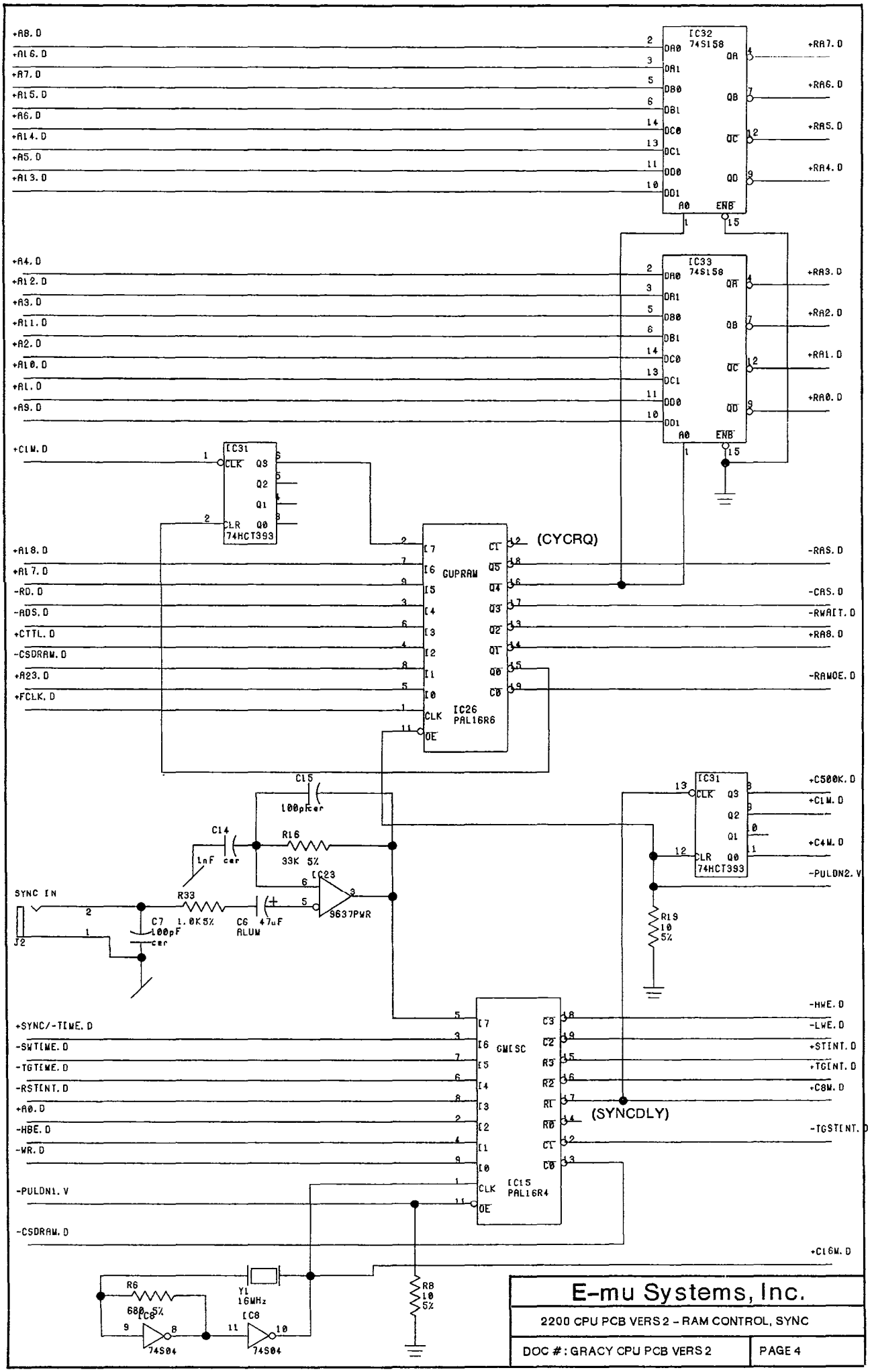
2200 CPU PCB VERS 2- ROM, FLOPPY

DOC # : GRACY CPU PCB VERS 2 | PAGE 3



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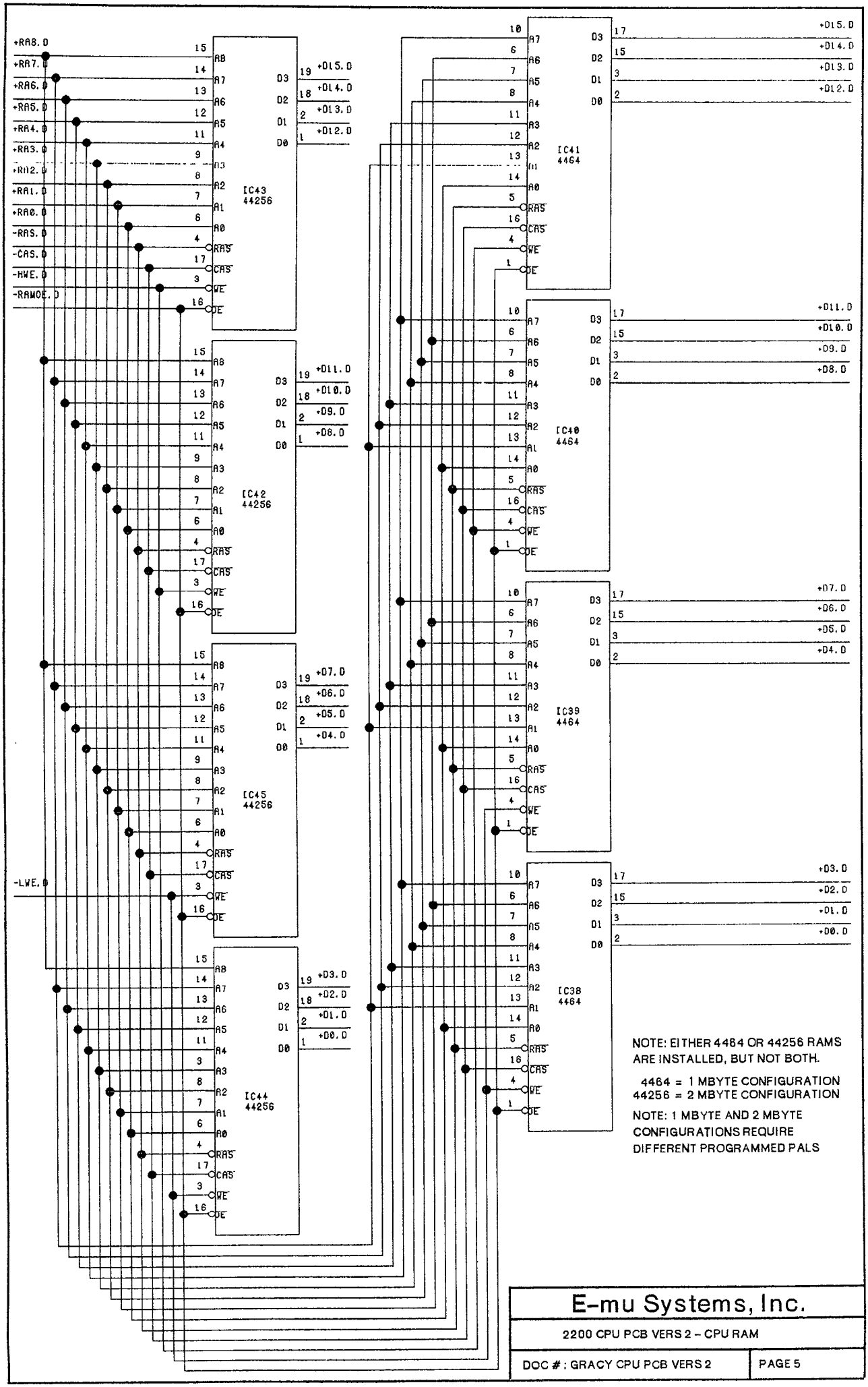
2200 CPU PCB VERS 2 - RAM CONTROL, SYNC

DOC #: GRACY CPU PCB VERS 2 | PAGE 4



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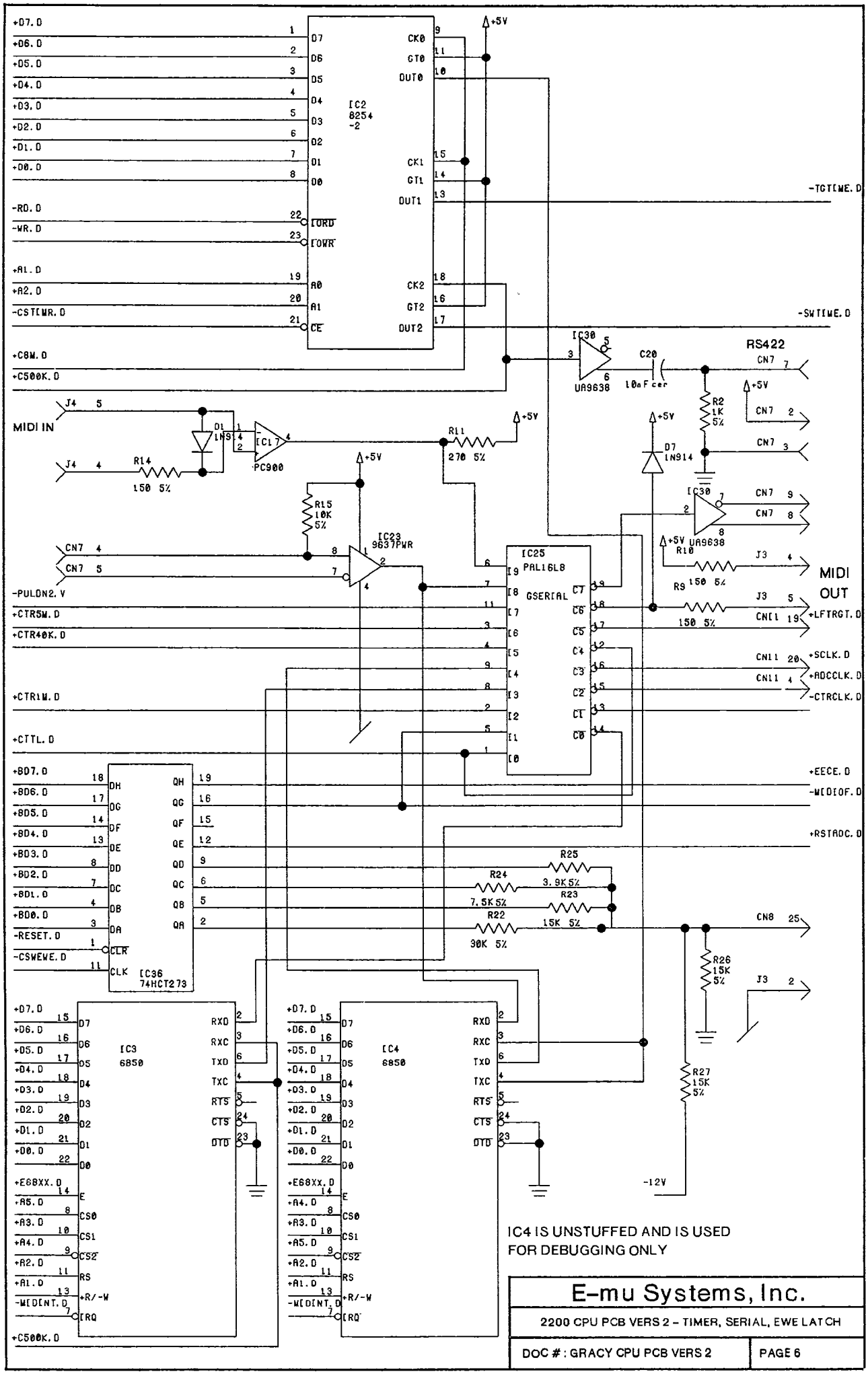
2200 CPU PCB VERS 2 – CPU RAM	
DOC # : GRACY CPU PCB VERS 2	PAGE 5



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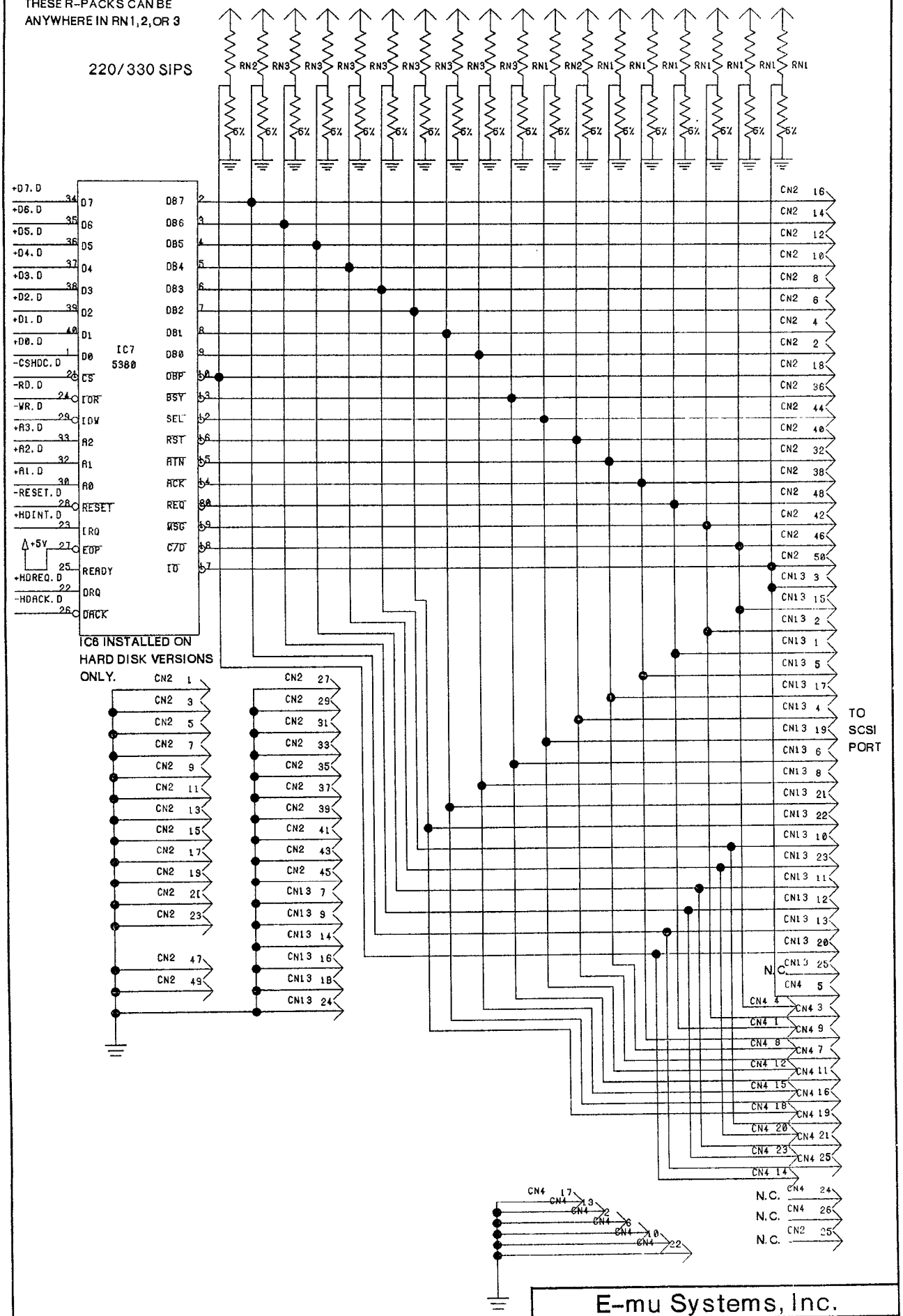
2200 CPU PCB VERS 2 - TIMER, SERIAL, EWE LATCH

DOC # : GRACY CPU PCB VERS 2 | PAGE 6



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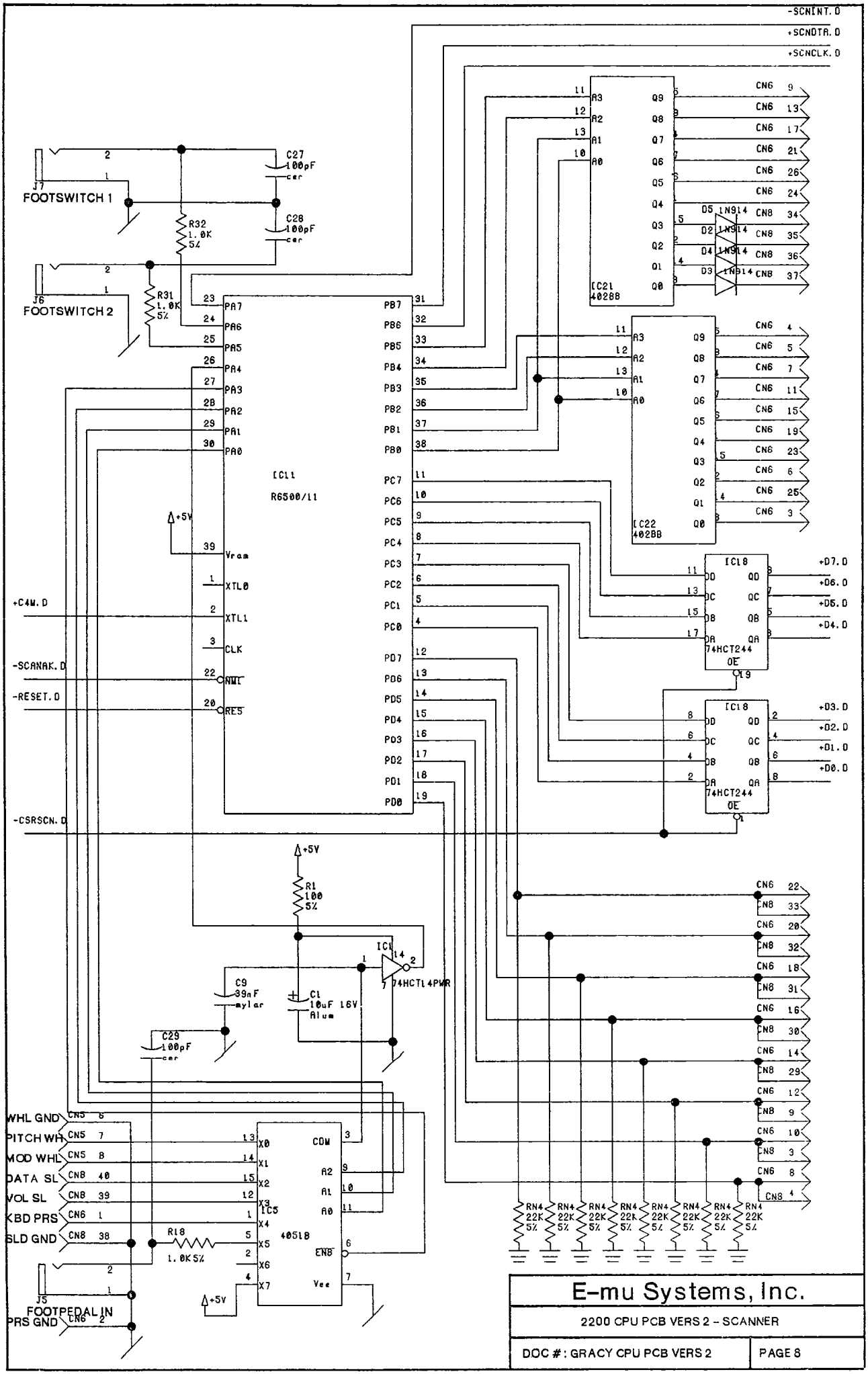
2200 CPU PCB VERS 2 - SCSI INTERFACE	
DOC #: GRACY CPU PCB VERS 2	PAGE 7


-SCNINT.D
+SCNDTR.D
+SCNCLK.D
FOOTSWITCH 1
FOOTSWITCH 2
C27 100pF cer
C28 100pF cer
R32 1.0K 5%
R31 1.0K 5%
IC11 R6500/11
IC21 40288
IC22 402BB
IC18 74HCT244
IC19 74HCT244
D5 1N914
D2 1N914
D4 1N914
D3 1N914
+5V
+C4M.D
-SCANAK.D
-RESET.D
-CSRSCN.D
+D7.D
+D6.D
+D5.D
+D4.D
+D3.D
+D2.D
+D1.D
+D0.D
R1 100 5%
C9 39nF mylar
C1 10uF 16V Alum
C29 100pF cer
IC1 74HCT14PWR
IC5 4051B
R18 1.0K5%
WHL GND
PITCH WHL
MOD WHL
DATA SL
VOL SL
KBD PRS
SLD GND
FOOTPEDAL IN
PRS GND
RN4 22K 5%
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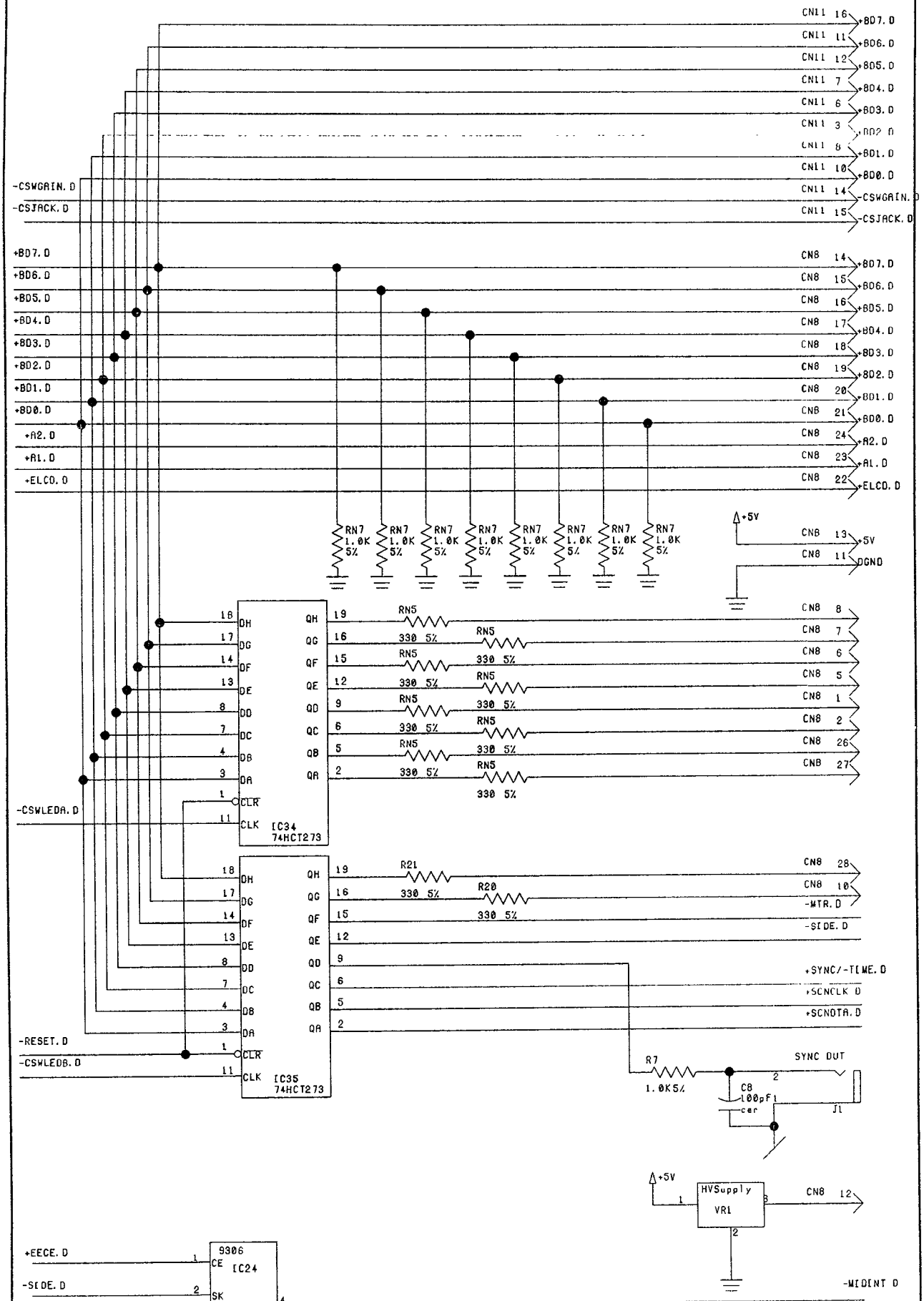
2200 CPU PCB VERS 2 - SCANNER
DOC #: GRACY CPU PCB VERS 2
PAGE 8



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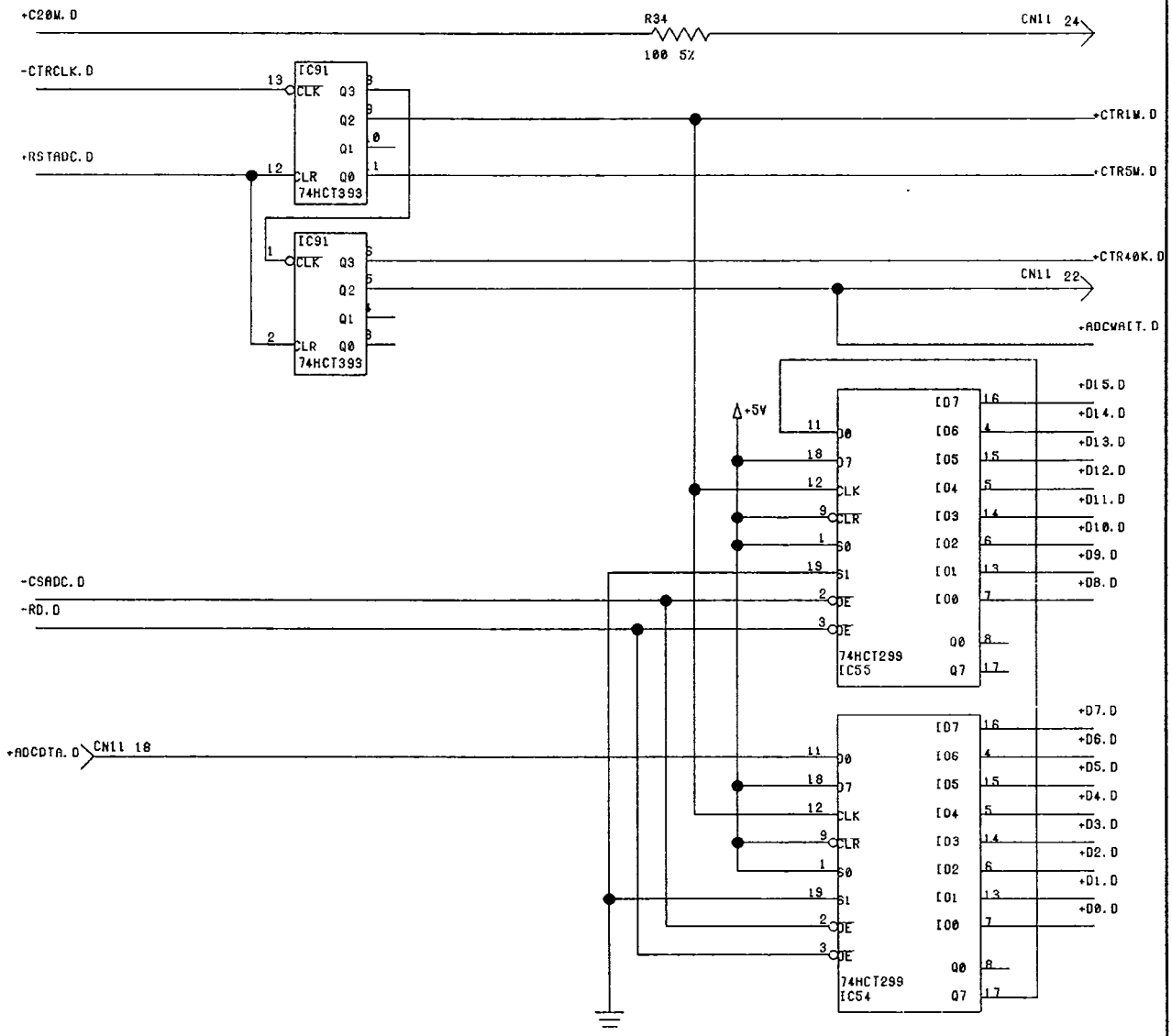
2200 CPU PCB VERS 2 - LED LATCHES, EEPROM	
DOC #: GRACY CPU PCB VERS 2	PAGE 9


+C20M.D
R34
100 5%
CN11 24
-CTRCLK.D
IC91
CLK
Q3
Q2
Q1
Q0
CLR
74HCT393
+RSTADC.D
+CTR1M.D
+CTR5M.D
+CTR40K.D
CN11 22
+ADCWAIT.D
+5V
+D15.D
+D14.D
+D13.D
+D12.D
+D11.D
+D10.D
+D9.D
+D8.D
-CSADC.D
-RD.D
IC55
74HCT299
+ADCDTA.D
CN11 18
+D7.D
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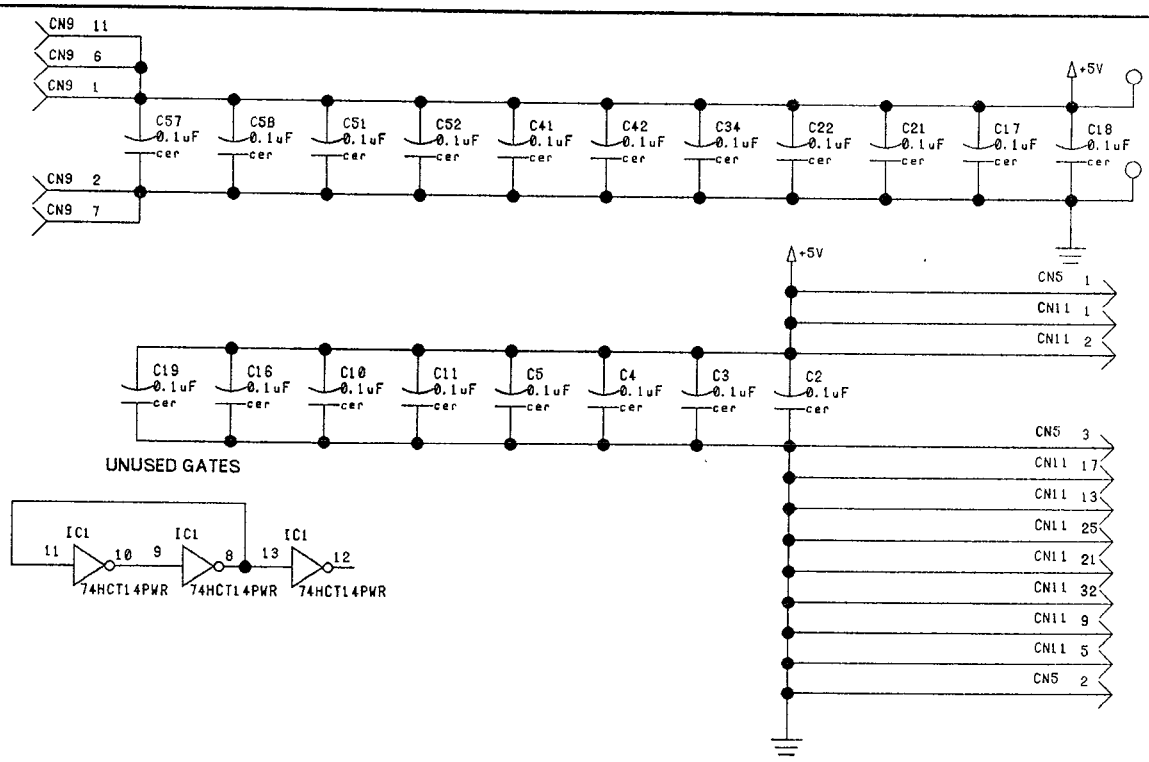
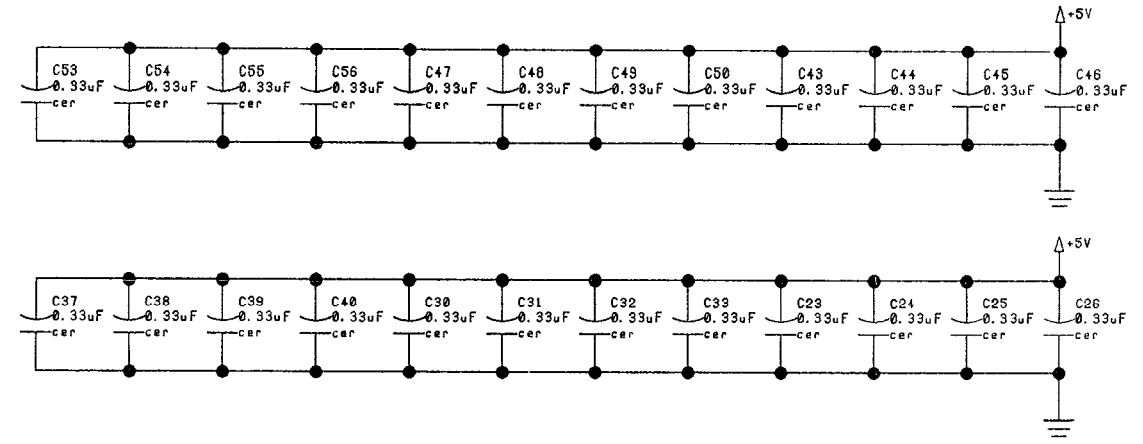
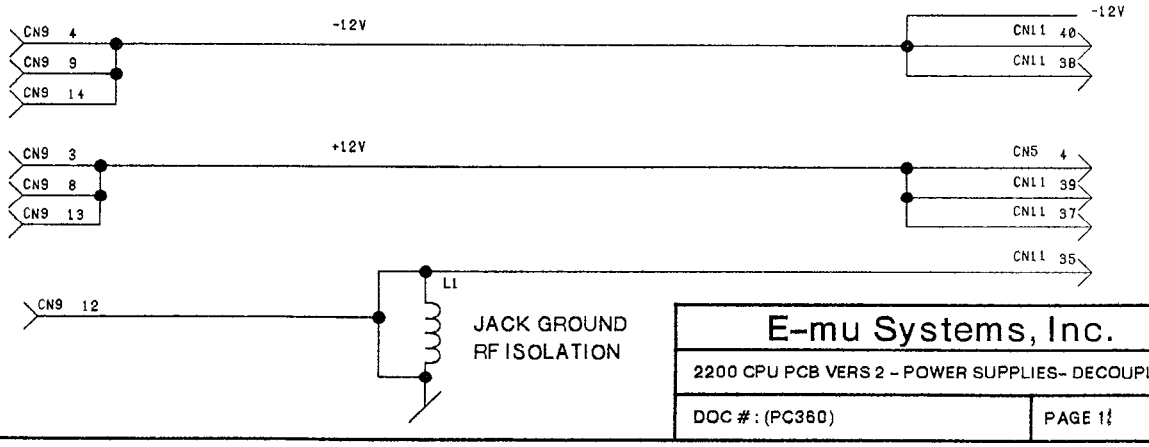
+D2.D
+D1.D
+D0.D
IC54







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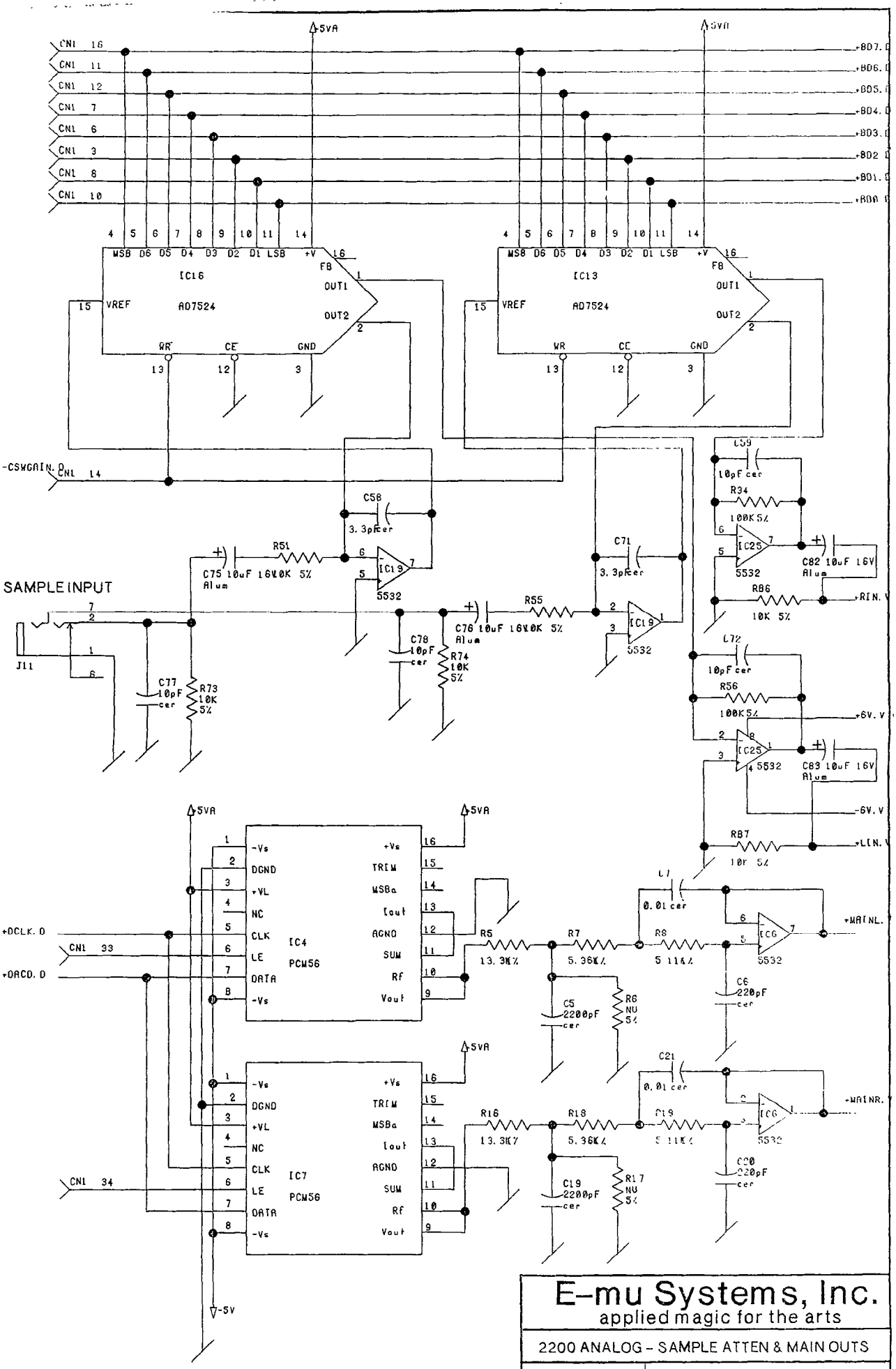
2200 CPU PCB VERS 2 - POWER SUPPLIES- DECOUPLING

DOC #: (PC360)



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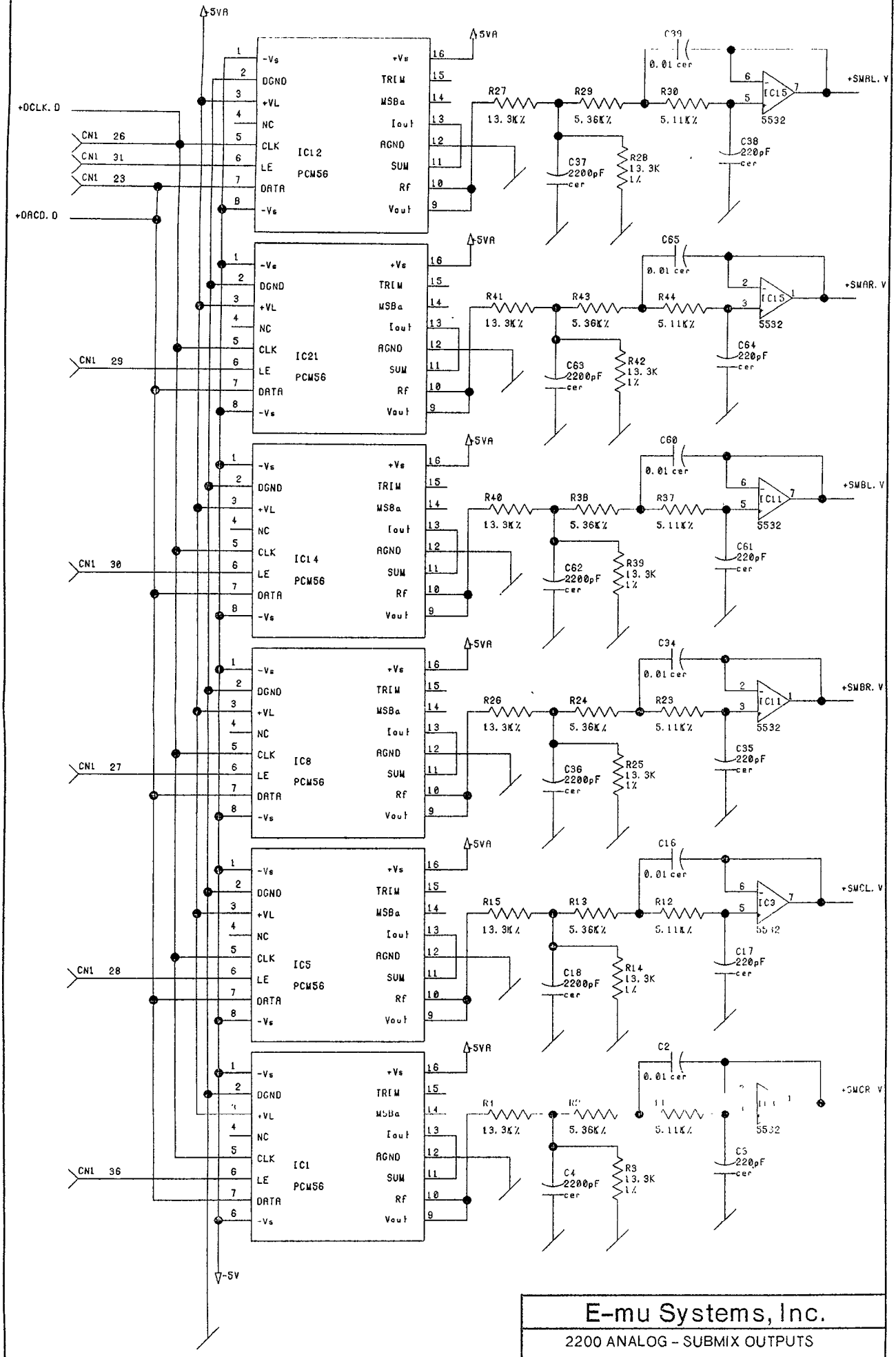
2200 ANALOG - SAMPLE ATTEN & MAIN OUTS

DRAWN BY: DPR	DOC # : SK120	
REV A	DATE 890720	PAGE 1 OF 5



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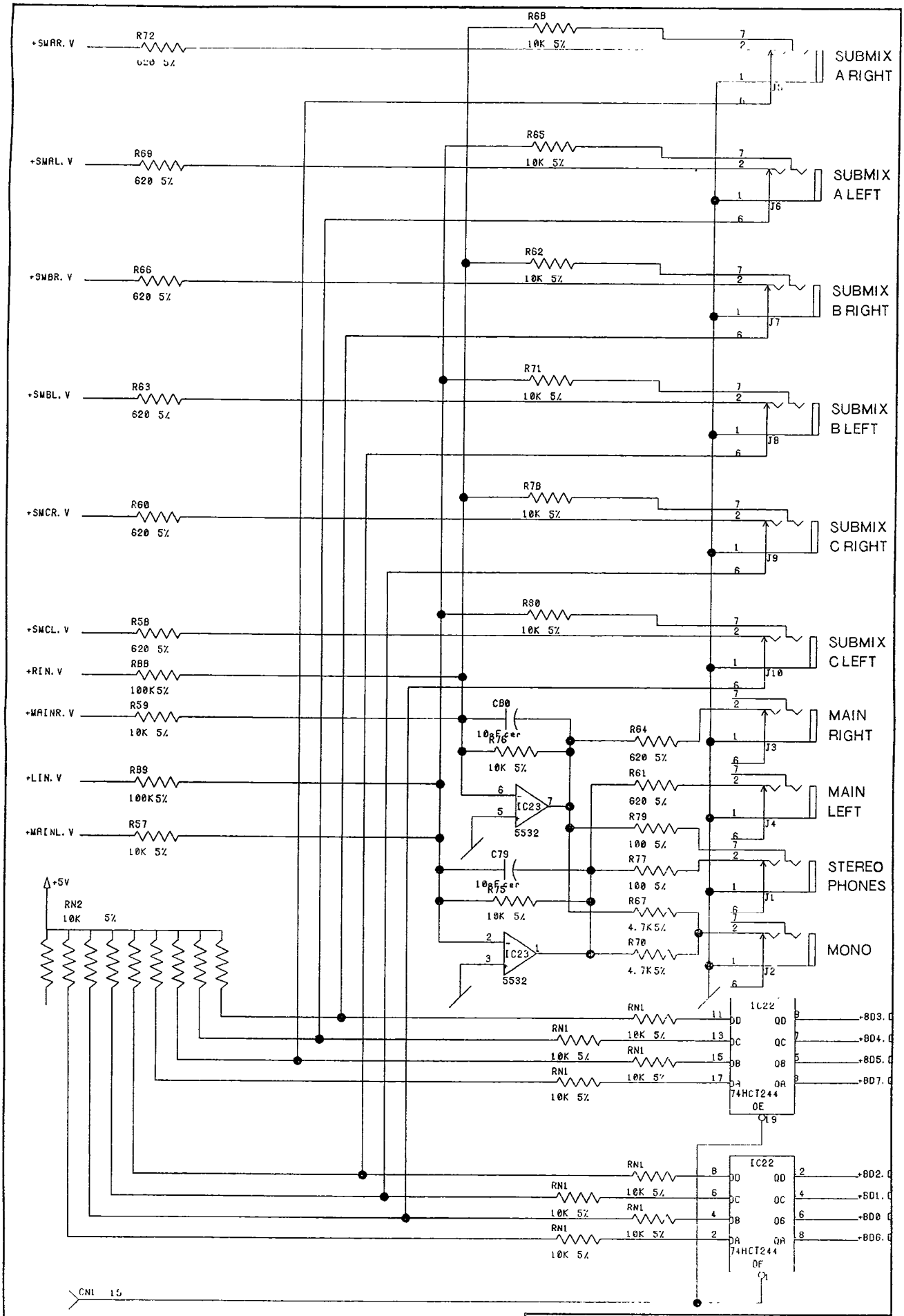
2200 ANALOG - SUBMIX OUTPUTS	
DOC # : SK120	PAGE 2 OF 5



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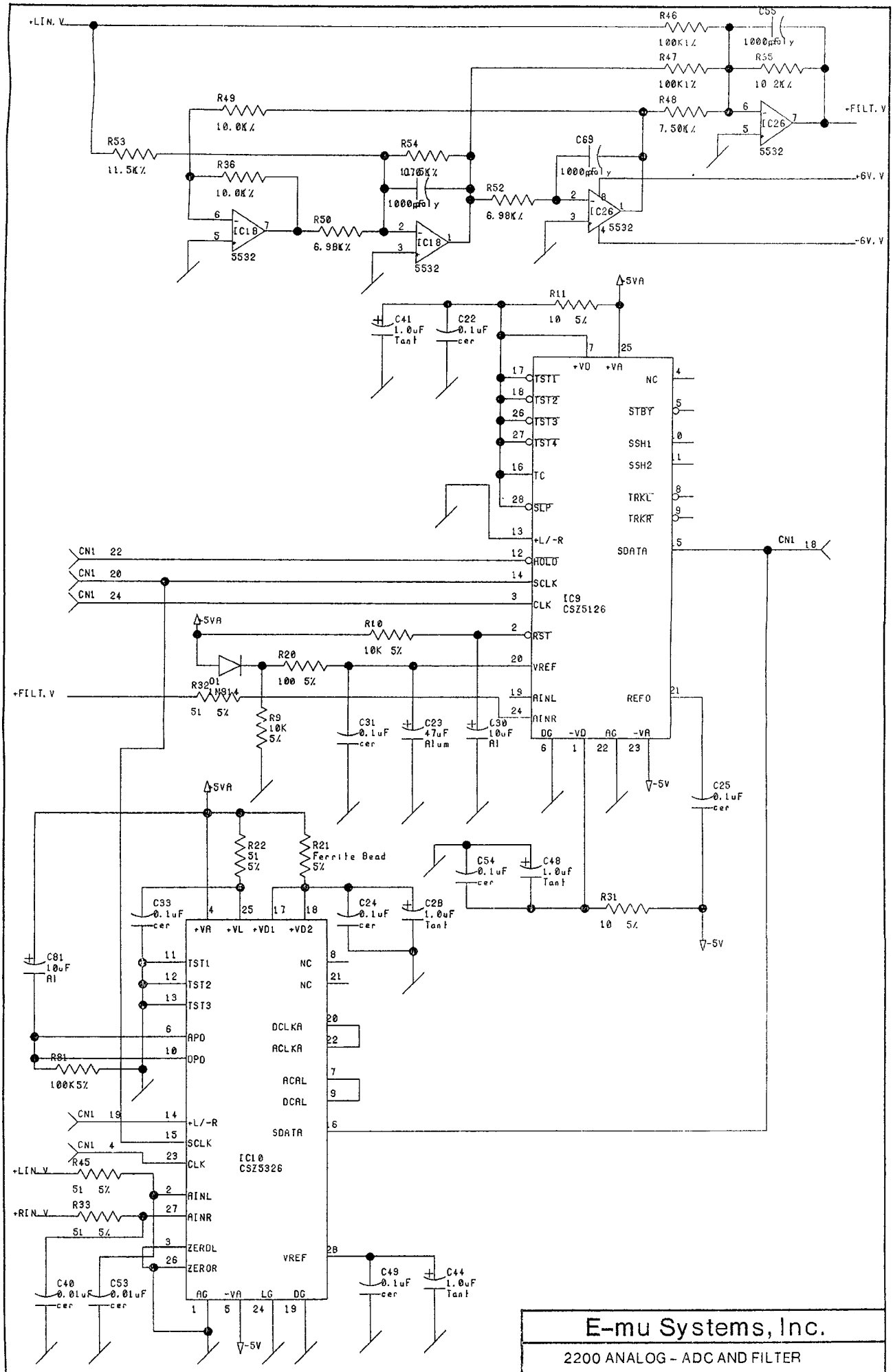
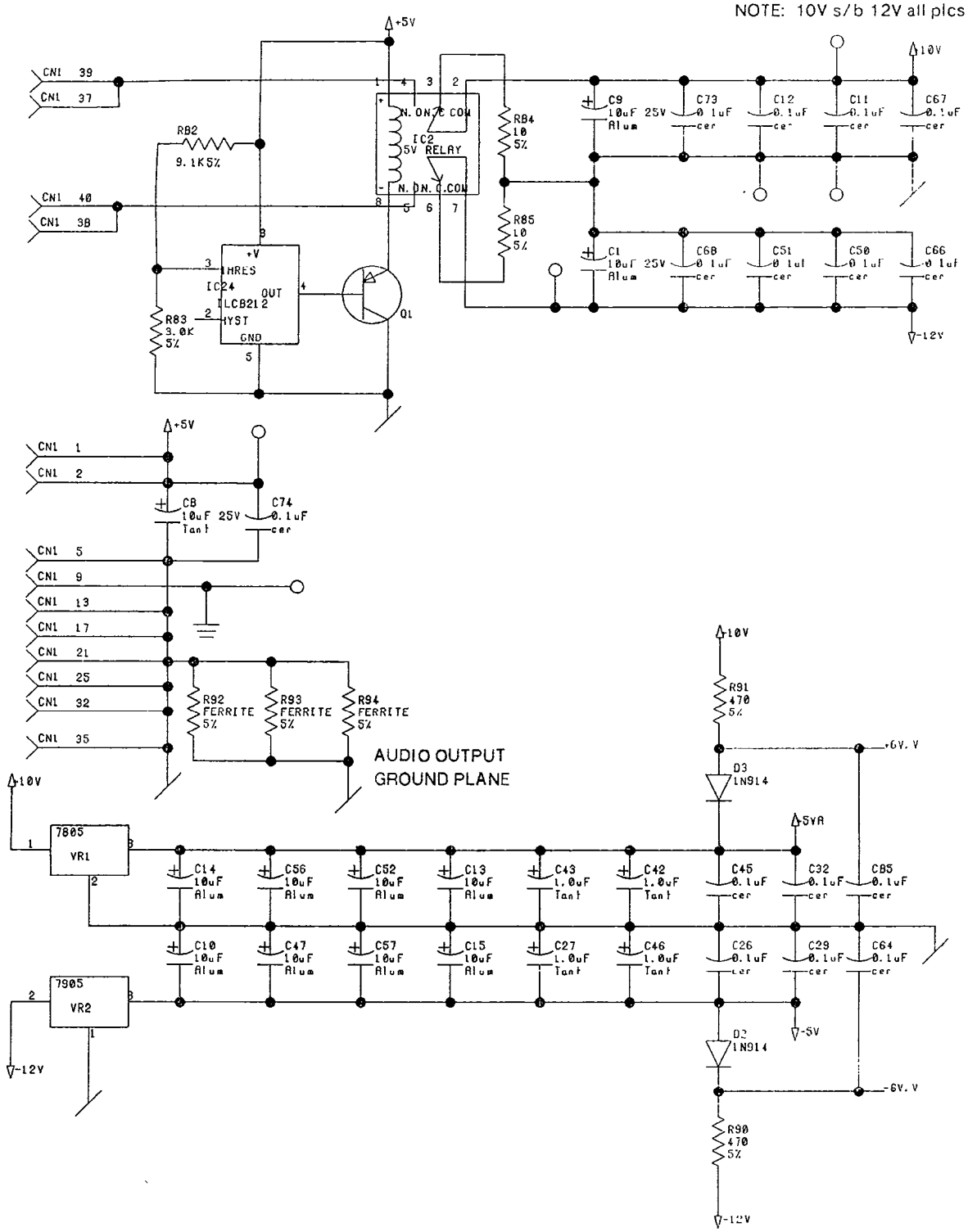
2200 ANALOG - MIXER AND JACKS

DOC # : SK120



E-mu Systems, Inc.	
2200 ANALOG - ADC AND FILTER	
DOC # : SK120	PAGE 4 OF 5

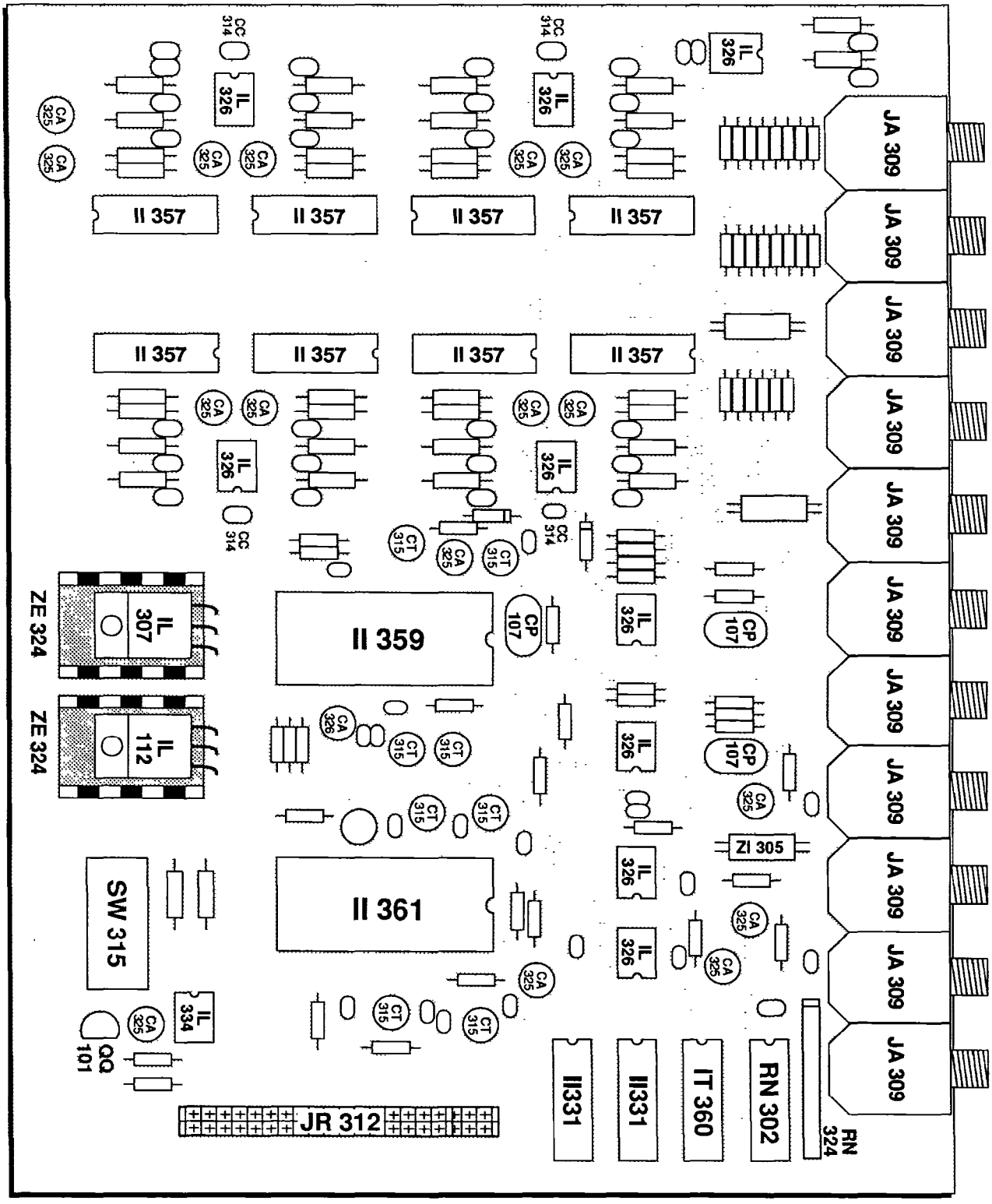
NOTE: 10V s/b 12V all plcs



E-mu Systems, Inc.	
2200 ANALOG - POWER SUPPLY	
DOC # : SK120	PAGE 5 OF 5

ASSEMBLY DIAGRAMS

EMAX II OUTPUT BOARD



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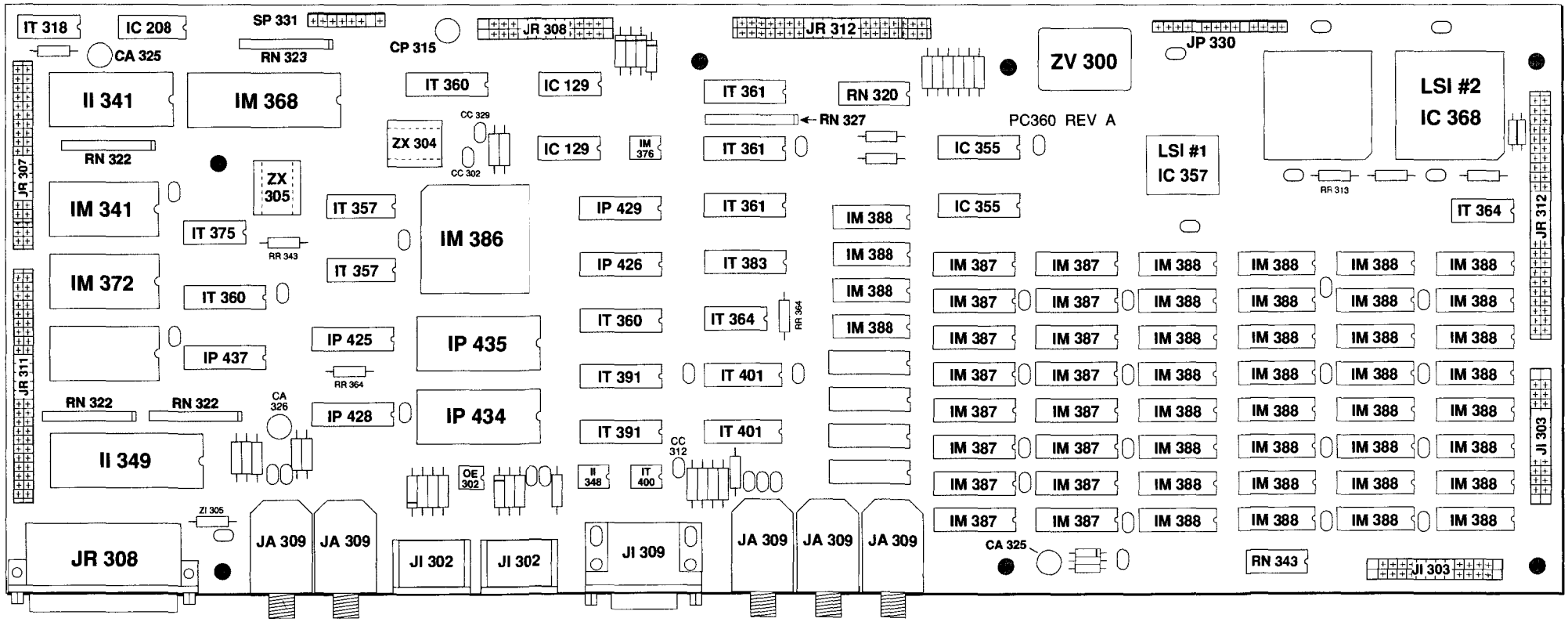
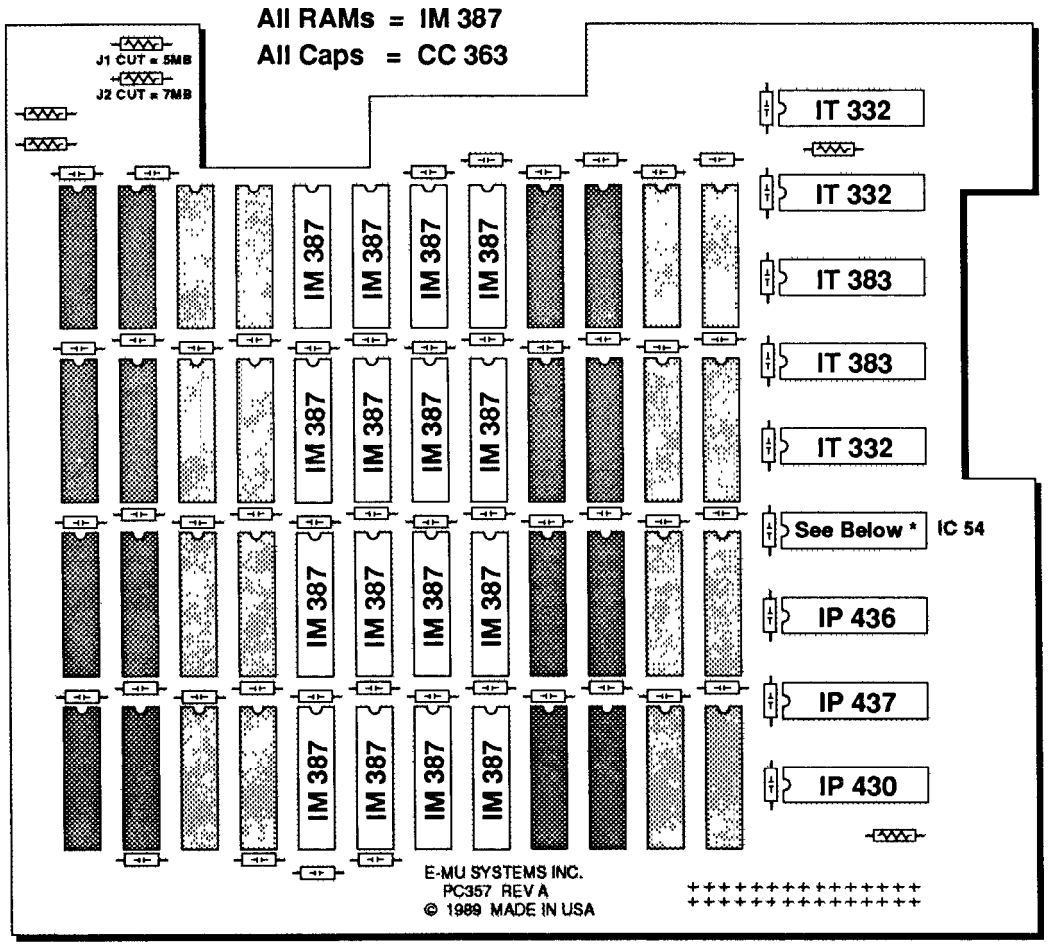


Emax II
CPU Board
AH100

EMAX II MEMORY EXPANSION BOARD (AH103)



= 7 or 8 Megabytes RAM
= 5 or 6 Megabytes RAM
= 3 or 4 Megabytes RAM

* 4 Meg ---> IC 54 = IP 438
5 Meg ---> IC 54 = IP 439
7 Meg ---> IC 54 = IP 440

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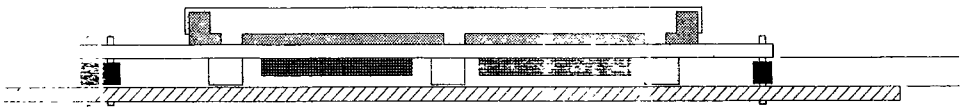
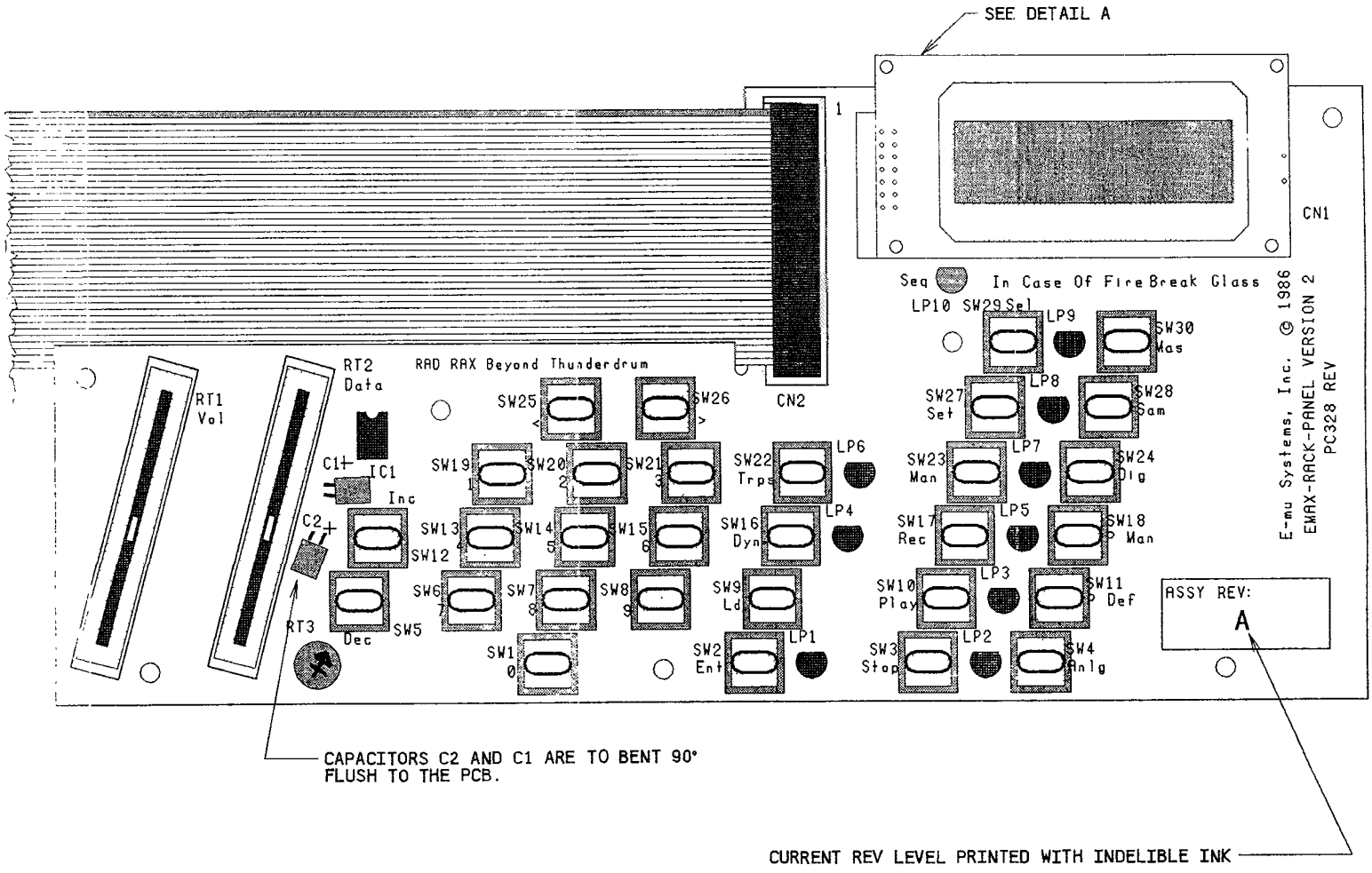
EMAX II RACK FRONT PANEL (AF133)



(FRONT VIEW OF DISPLAY)
DETAIL A



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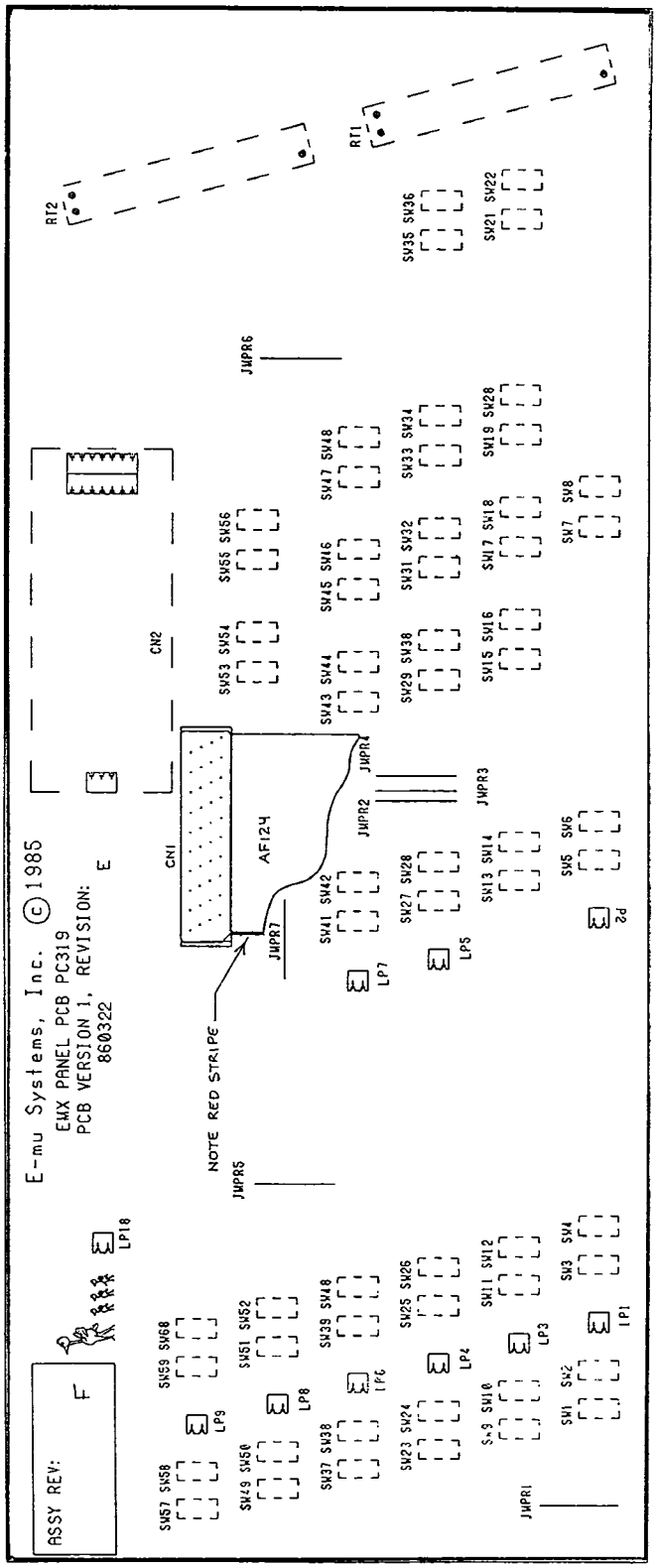
EMAX II KEYBOARD FRONT PANEL (AF105)



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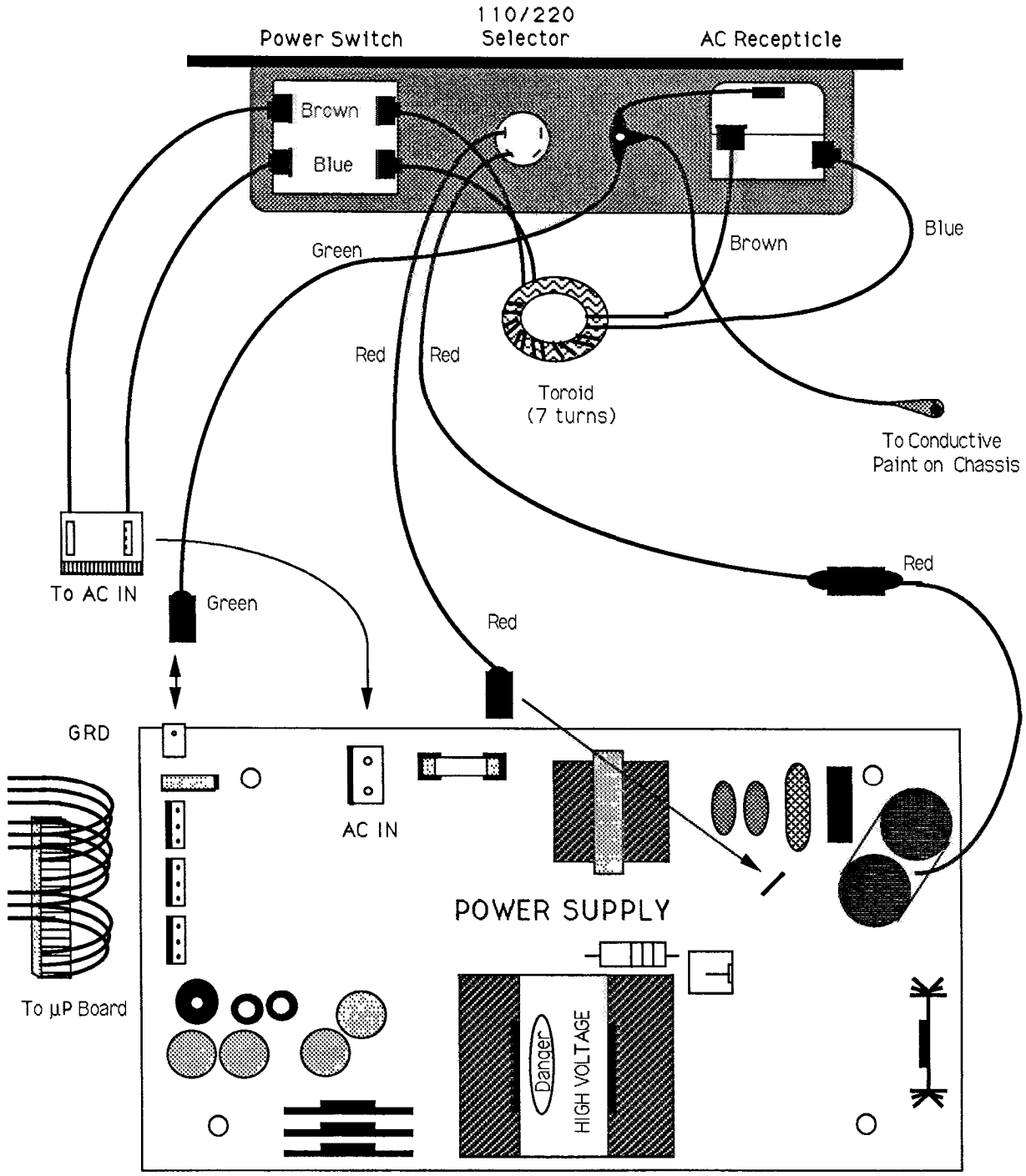
EMAX II KEYBOARD AC WIRING DIAGRAM



Note:
The Voltage Selector Switch is not necessary on certain Emax II Power Supplies.

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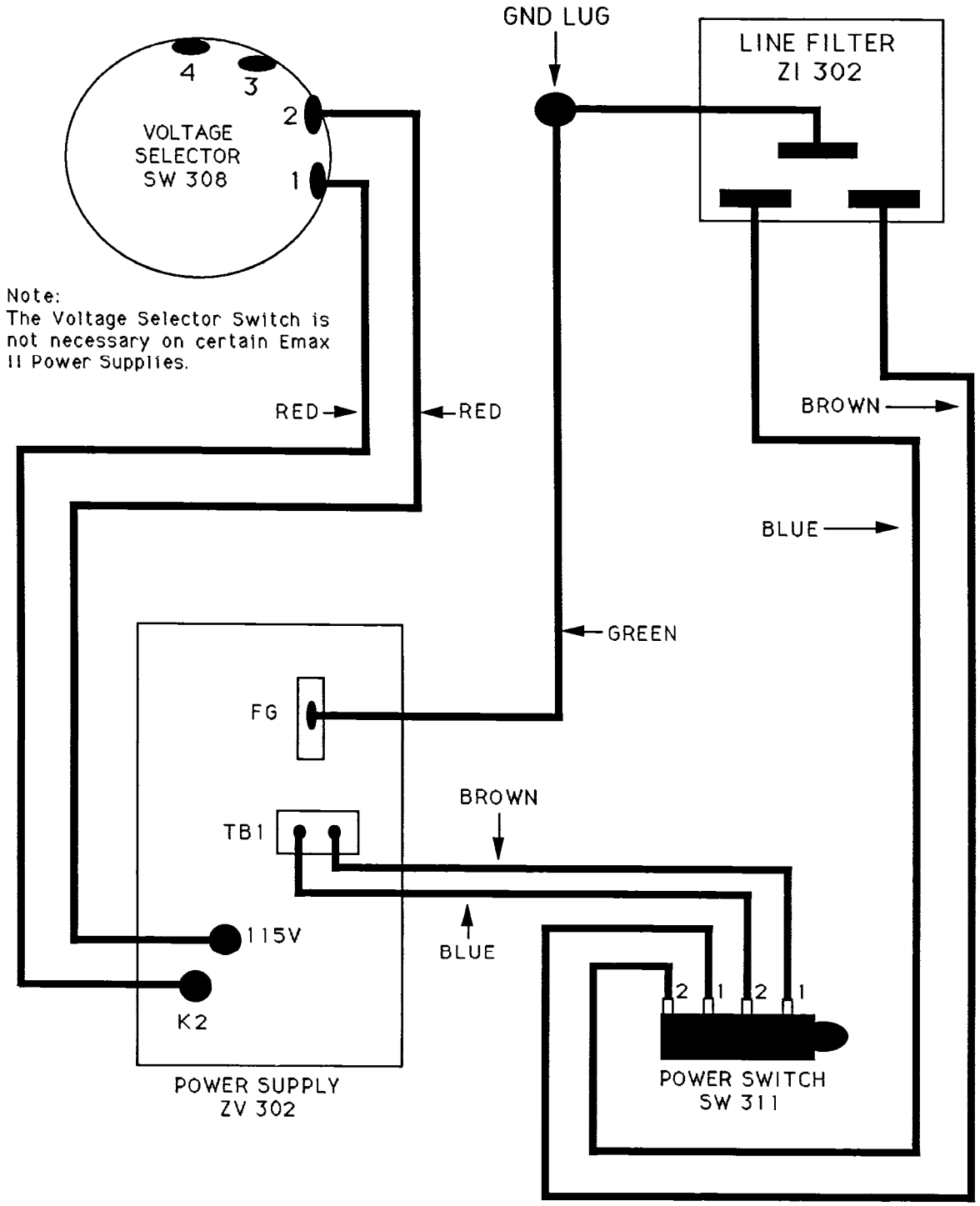
EMAX II RACK AC WIRING DIAGRAM



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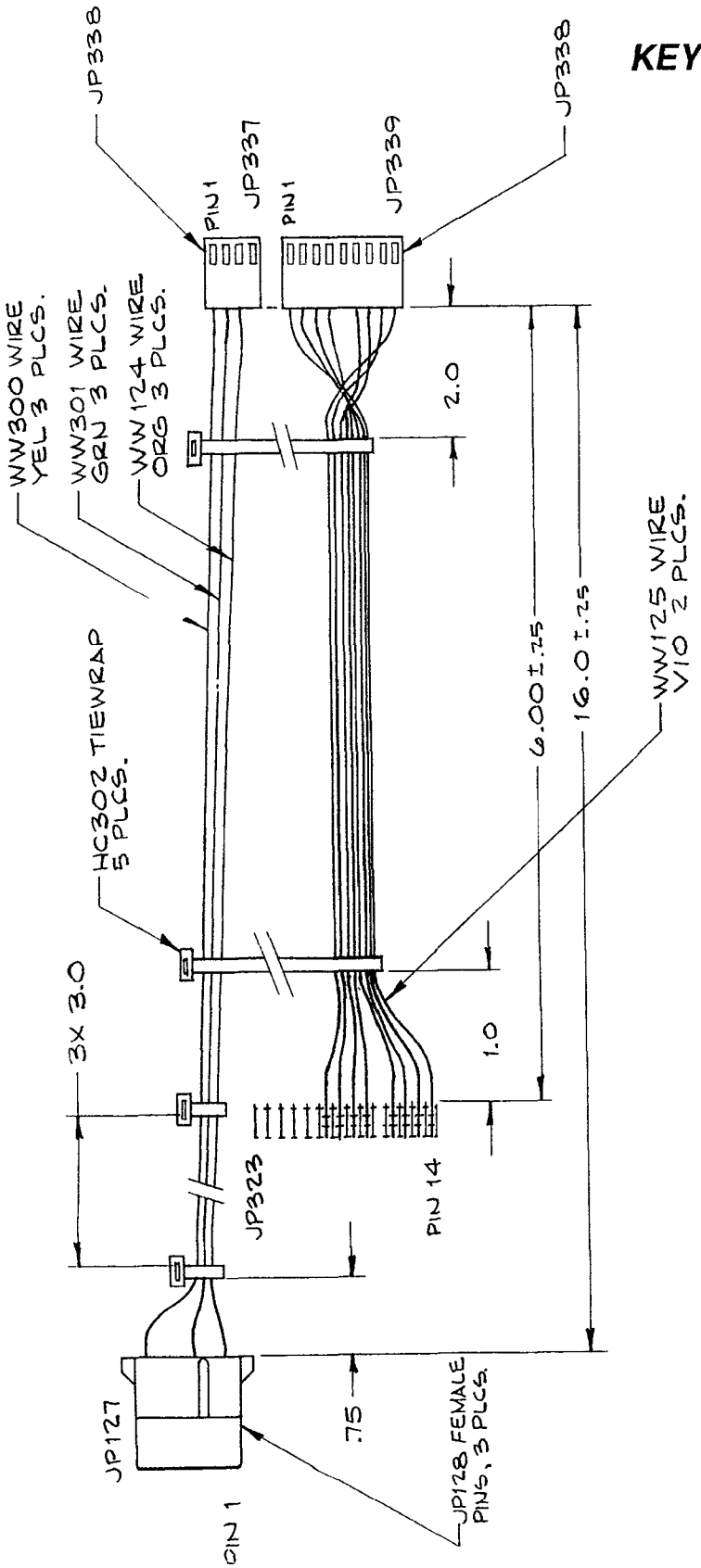
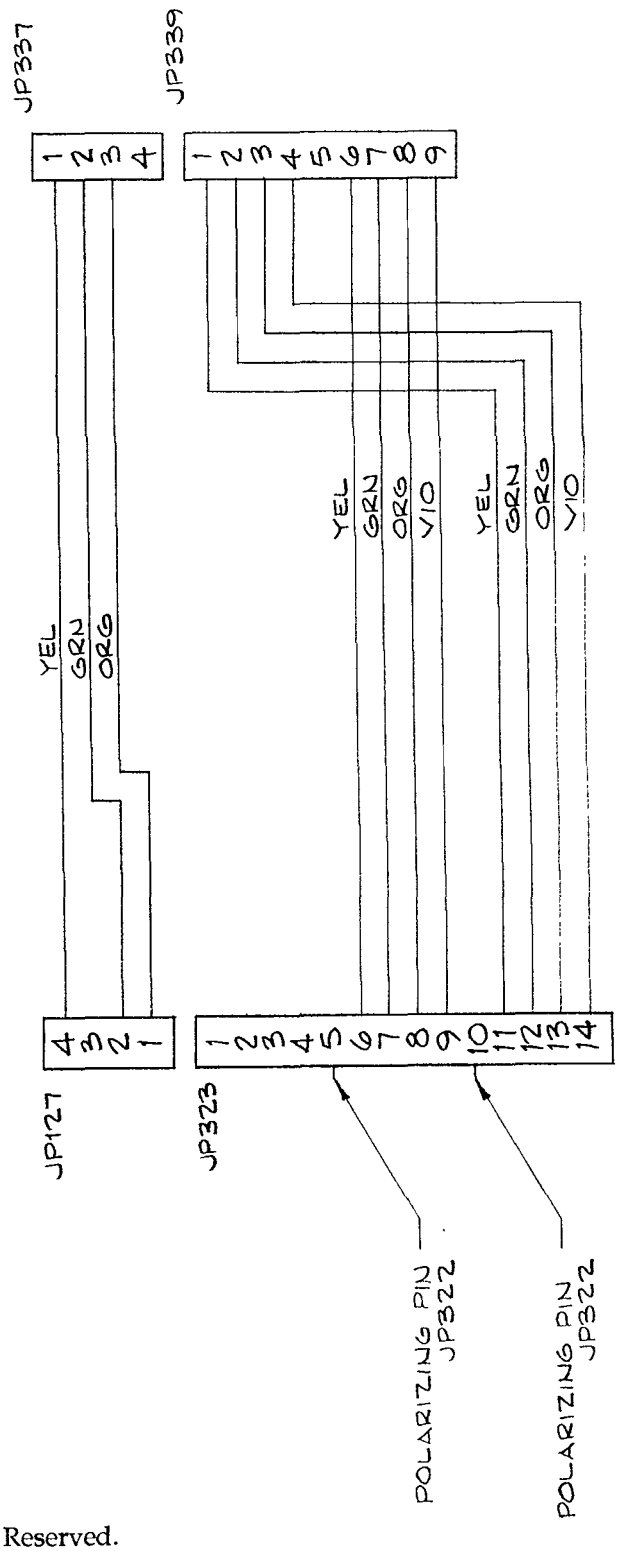
KEYBOARD AC POWER CABLE (AF177)





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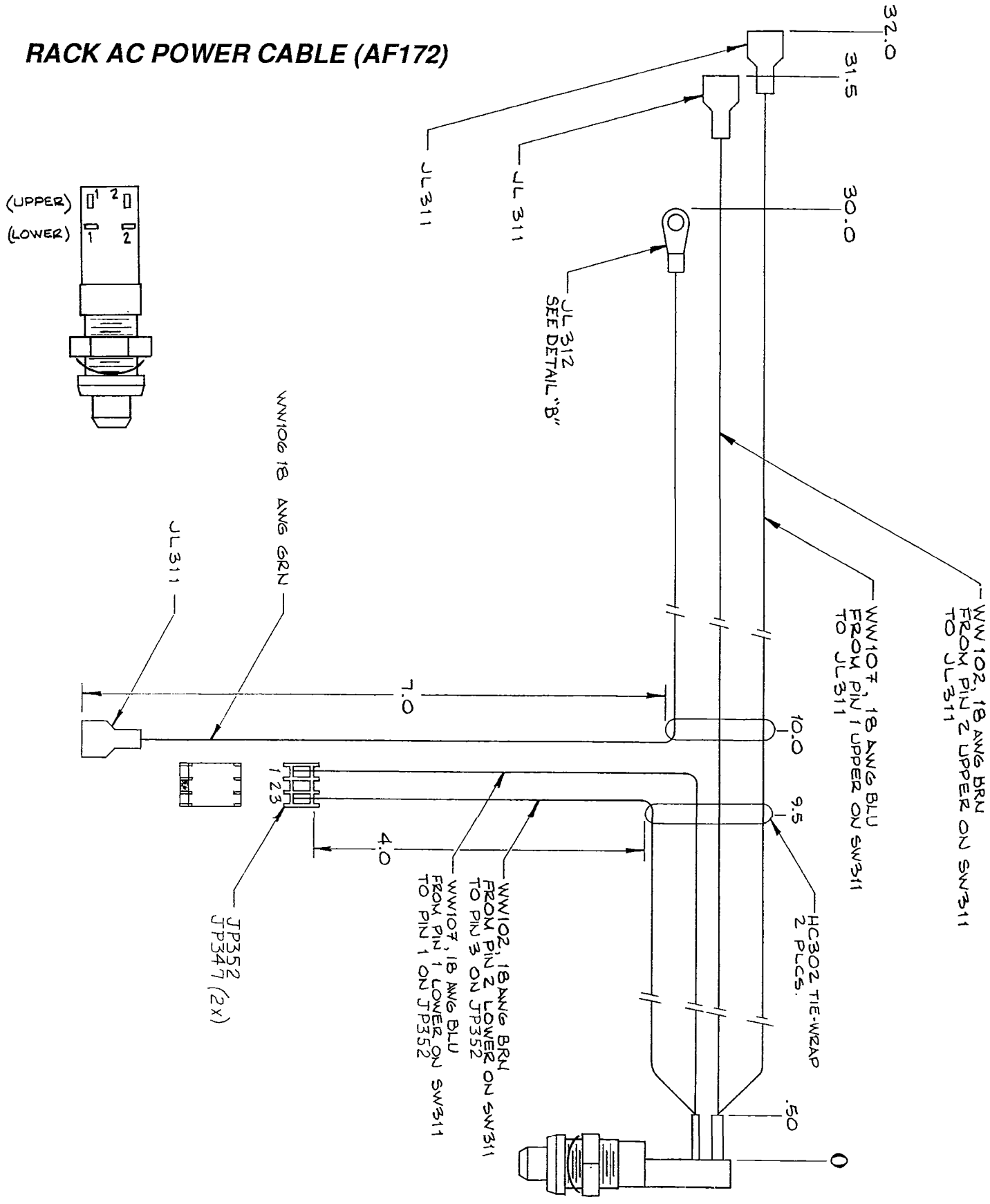
RACK AC POWER CABLE (AF172)



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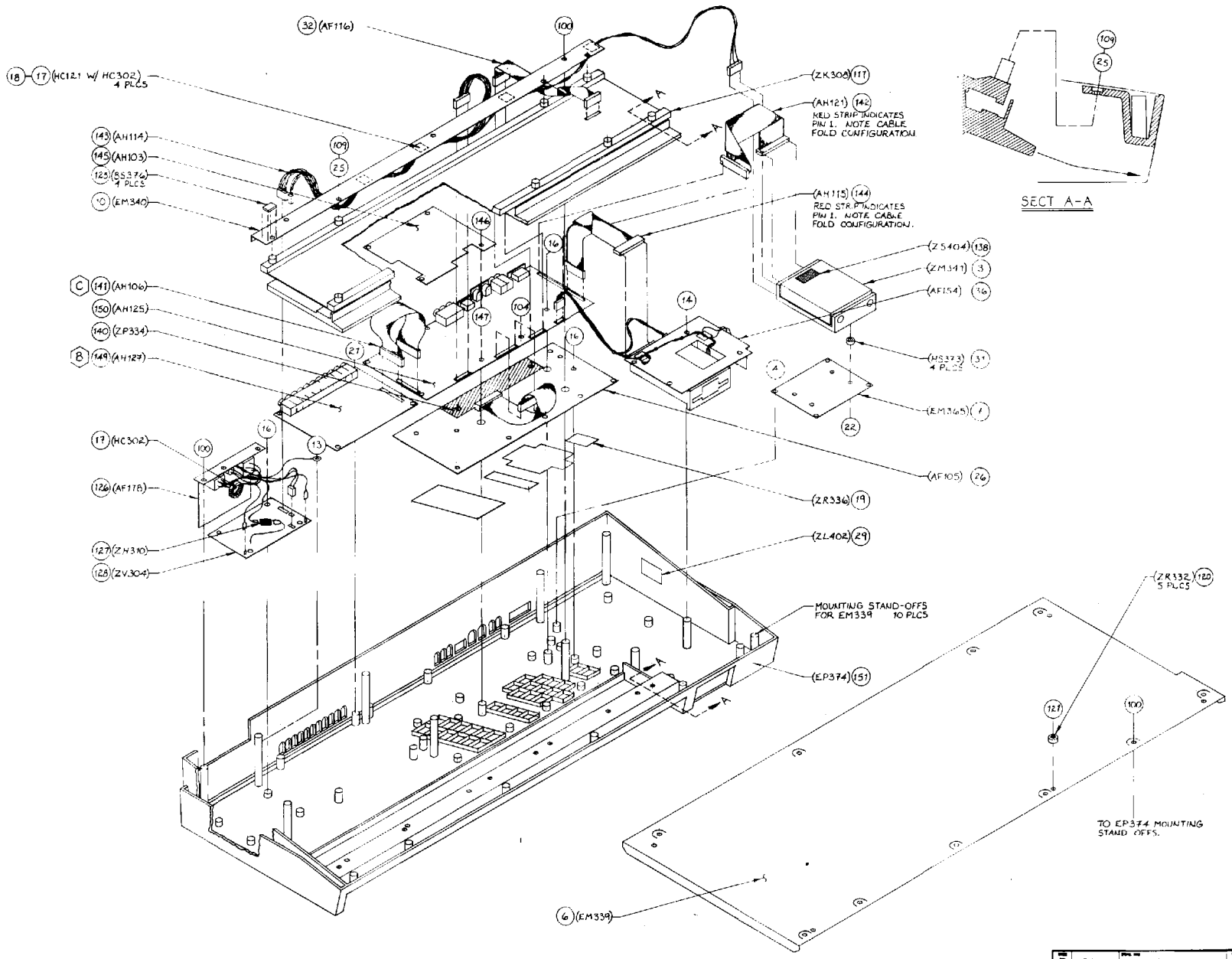
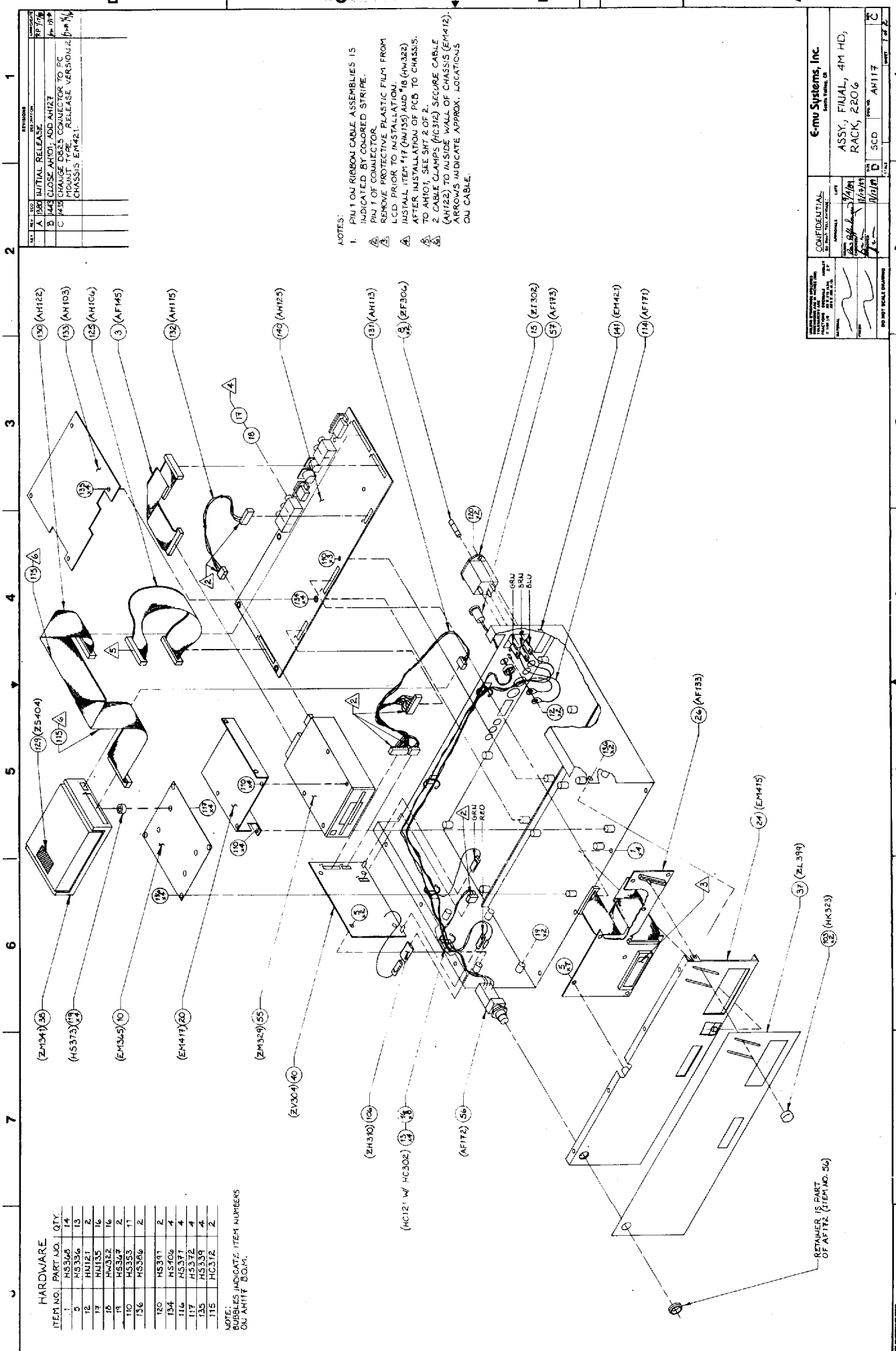
HARDWARE

ITEM NO.	PART NO	QTY.
13	HS358	1
14	HS364	4
16	HS363	16
21	HS353	6
139	HS371	10
25	HW329	10
100	HS327	5
104	HS347	1
109	HS354	10
121	HS122	5
147	HS406	4
4	HS370	4
22	HS372	4
146	HS339	4

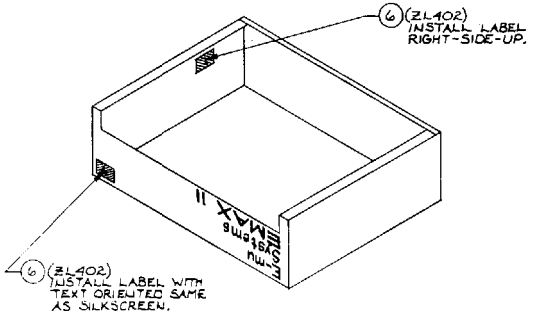
NOTE: BUBBLES INDICATE ITEM NUMBERS ON AH116 B.O.M.

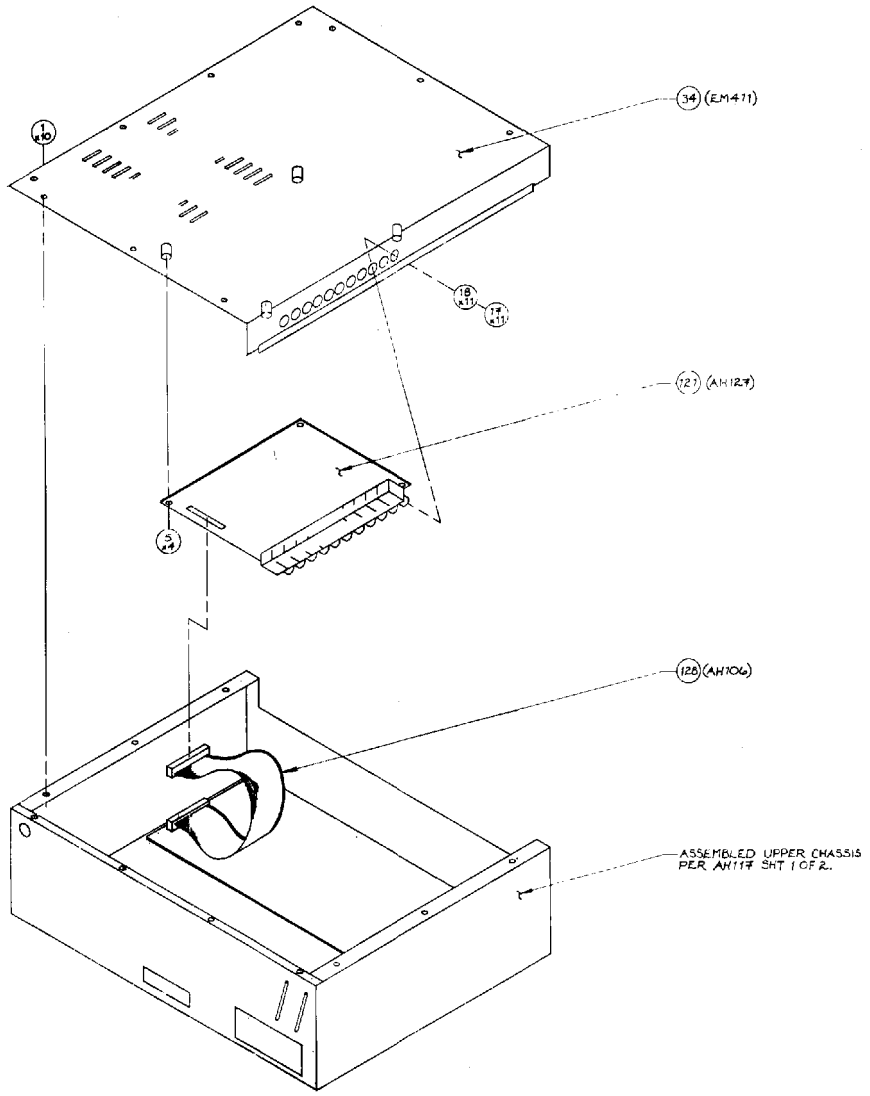


D SCD AH116 C
E-MU SYSTEMS SHEET 2 of 2


REVISIONS
SET REV ECO DESCRIPTION DATE APPROVED
A 1360 INITIAL RELEASE 8/17/88
B 1443 CLOSE AH101, ADD AH127 1/19/89
C 1439 CHANGE DB25 CONNECTOR TO PC MOUNT TYPE. RELEASE VERSION 2 CHASSIS EM421. 4/4/89
NOTES:
1. PIN 1 ON RIBBON CABLE ASSEMBLIES IS INDICATED BY COLORED STRIPE. PIN 1 OF CONNECTOR.
3 REMOVE PROTECTIVE PLASTIC FILM FROM LCD PRIOR TO INSTALLATION.
4 INSTALL ITEM #17 (HW135) AND #18 (HW382) AFTER INSTALLATION OF PCB TO CHASSIS. TO AH101, SEE SHT 2 OF 2.
5 2 CABLE CLAMPS (HC312) SECURE CABLE (AH122) TO INSIDE WALL OF CHASSIS (EM412). ARROWS INDICATE APPROX. LOCATIONS ON CABLE.
CONFIDENTIAL
E-mu Systems, Inc.
Scotts Valley, CA
ASSY, FINAL, 4M HD, RACK, 2206
SIZE D SCO DWG NO. AH117 REV C
SCALE: 1/4 SHEET 1 OF 2
DO NOT SCALE DRAWING
HARDWARE
ITEM NO. PART NO. QTY.
1 HS366 14
5 HS336 13
12 HN121 2
17 HN135 16
18 HW382 16
19 HS347 2
110 HS353 11
136 HS386 2
120 HS391 2
134 HS406 4
116 HS371 4
117 HS372 4
135 HS339 4
115 HC312 2
NOTE: BUBBLES INDICATE ITEM NUMBERS ON AH117 B.O.M.
(ZM1341) 36
(HS373) 19 x4
(EM345) 10
(EM417) 20
(ZM329) 55
(ZV304) 40
(ZH310) 106
(HC121 W/ HC302) 13 x4
(AF172) 56
(HK323) 125 x2
RETAINER IS PART OF AF172. (ITEM NO. 56)
(ZL394) 37
(EM421) 21
(EM415) 24
(AF133) 26
(AF171) 114
(AF173) 57
(ZF308) 15
(EM421) 141
(AF304) 42
(AH113) 131
(AH125) 140
(AH115) 132
(AH106) 125
(AH103) 133
(AH122) 130
(ZS404) 129
GRN
BRN
BLU
RED

SERIAL NUMBER LABEL LOCATIONS





SIZE	SCD	DRWG NO.	REV
D	SCD	AH117	C
SCALE		SHEET 2 of 2	

EMAX II PARTS LIST

EMAX II PARTS LIST

ORDERING PARTS: Parts can be ordered by written order or by phone. When ordering parts, you MUST order by E-mu part number. The minimum parts order is $15.00. Emergency rush orders can usually be sent out the same day if the order is received by 11:00 PST. Parts orders can be placed between the hours of 8:30 am and 5:30 pm PST Monday through Friday. E-mu Customer Service Department (408) 438-1921.

EMAX II FINAL ASSEMBLY

PART	E-MU P/N	QUANTITY
Front Panel PCB (KYBD)	AF105	1
KYBD → CPU	AF116	1
Front Panel PCB (Rack)	AF133	1
Pitch Wheel Assembly	AF154	1
PS → CPU + HD Cable (Rack)	AF172	1
PS → CPU + HD Cable (KYBD)	AF177	1
AC Panel (KYBD)	AF178	1
SCSI Cable	AF240	1
Non-Turbo CPU PCB	AH100	1
Mono Analog PCB	AH101	1
Memory Expansion PCB	AH103	1
CPU Board to Analog Board Cable	AH106	1
Turbo CPU Board	AH107	1
CPU → Floppy Cable	AH115	1
CPU → HD Cable (KYBD)	AH121	1
CPU → HD Cable (Rack)	AH122	1
Stereo Analog PCB	AH127	1
Neoprene Rubber Strip (KYBD)	BS376	1
Metal Bottom Panel (KYBD)	EM339	1
Keyboard Bracket	EM340	1
Hard Drive Mounting Plate	EM365	1
Rack Chassis Lower	EM411	1
Rack Chassis Upper	EM412	1
SCSI Port Mounting Plate (KYBD)	EM413	1
Rack Chassis Panel	EM415	1
Plastic Housing (KYBD)	EP365	1
Cable Stickdown	HC121	4
Tie Wrap	HC302	6
Slider Knob (Button)	HK323	2
4-40 Nut (SCSI Plate Mouning)	HN304	4
3/8" 8-32 Screw (KYBD rubber feet)	HS122	5
1/4" 8-32 Screw (KYBD brkt)	HS327	5
1/4" 6-32 Screw (Mem. Exp. PCB)	HS339	4
Plastic F.P. Quick Connect (KYBD)	HS347	1
1/4" 6-32 PCB Screw	HS353	7

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EMAX II PARTS LIST

FINAL ASSEMBLY (cont)		
M3x10 Lk Wshr Screw (KYBD Brkt)	HS354	10
8x 1/4" Grnd Strap Screw (KYBD)	HS358	1
3/8" 6-19 Inplas Screw (KYBD)	HS363	16
3/8" 6-18 Inplas Screw (KYBD PWH)	HS364	4
1/4" 8-18 Screw (KYBD Btm Pnl)	HS371	10
1/2" 6-32 Screw HD Mount	HS372	4
Aluminum Spacer HD Mount	HS373	4
DB-25 Mounting Set (8 piece)	HS400	1
1/2" 4-40 SCSI Mount Screw	HS405	4
CPU → Mem. Board Hex Spacer	HS406	4
Stereo Cable Adapter	WC314	1
5-Octave Keyboard	ZK308	1
3.5" Floppy Disk Drive	ZM329	1
40 Mbyte Hard Disk Drive	ZK341	1

EMAX II CPU BOARD

CAPACITORS	E-MU P/N	QUANTITY
10µF 25V Alum. Radial	CA325	2
47µF 16V Alum.	CA326	1
100pF Ceramic	CC103	6
1000pF 1KV Ceramic	CC106	1
22pF 50V Ceramic	CC302	1
.01µF 50V Ceramic	CC312	1
.1µF 50V Radial Ceramic	CC314	19
33pF 50V Ceramic	CC329	1
33µF 50V Ceramic	CC334	24
.039µF 50V Plastic	CP315	1

CAP. LOCATION →	E-MU P/N
C1	CA325
C2-5	CC314
C6	CA326
C7-8	CC103
C9	CP315
C10-11	CC314
C12	CC302
C13	CC329
C14	CC106
C15	CC103
C16-19	CC314

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EMAX II PARTS LIST

CPU BOARD CAPACITORS (cont)

C20 ---------- CC312
C21-22 ---------- CC314
C23-26 ---------- CC334
C27-29 ---------- CC103
C30-33 ---------- CC334
C34 ---------- CC314
C35 ---------- CA325
C37-40 ---------- CC334
C41-42 ---------- CC314
C43-50 ---------- CC334
C51-52 ---------- CC314
C53-56 ---------- CC334
C57-58 ---------- CC314

ICs	E-MU P/N	QUANTITY
4028 CMOS Decoder	IC129	2
4051 CMOS Analog Mux	IC208	1
74HCT299 CMOS 8-bit Shift Reg.	IC355	2
WD1772 Floppy Controller	II341	1
9637A Dual Differential Receiver	II348	1
5380 SCSI Controller	II349	1
8254-2 Interval Timer	IM341	1
6500/11 Scanner µP (custom mask)	IM368	1
6850 USART	IM372	1
EEPROM	IM376	1
32CG16-10 CPU	IM386	1
4464 64Kx4 DRAM	IM388	36
PAL GCS 2200	IP425	1
PAL GUPRAM 2200	IP426	1
PAL GINTWT 2200	IP427	1
PAL GMISC 2200	IP428	1
PAL GMONO 2200	IP429	1 *
EPROM LS Boot	IP434	1
EPROM MS Boot	IP435	1
PAL GSTEREO 2200	IP457	1 †
74HCT138 3-8 Decoder	IT357	2
74HCT244 Octal Buffer	IT360	3
74HCT273 Octal Flip-Flop	IT361	3
74HCT393 Dual 4-bit Counter	IT364	2
74S04 Hex Inverter	IT375	1
74HCT245 Octal Tri-State Buffer	IT383	1
74HCT373 Octal Latch	IT391	2
74HCT14 Hex Inverter	IT398	1
UA9638 Dual Line Driver	IT400	1

** - not installed on stereo Emax II*

† - only installed on stereo Emax II

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EMAX II PARTS LIST

CPU IC's (cont)		
74S158 2-Input Quad Mux.	IT401	2
PC900 Iso-Optolator	OE302	1
LCD H.V. Power Supply	ZV300	1
20.0 MHz Crystal	ZX304	1
16.0 MHz Crystal	ZX305	1

IC LOCATION →	E-MU P/N
IC1	IT398
IC2	IM341
IC3	IM372
IC5	IC208
IC6	II 341
IC7	II 349
IC8	IT375
IC9	IT360
IC10	IP427
IC11	IM368
IC12-13	IT357
IC14	IP425
IC15	IP428
IC16	IM386
IC17	OE302
IC18	IT360
IC19	IP435
IC20	IP434
IC21-22	IC129
IC23	II 348
IC24	IM376
IC25	IP429
IC26	IP426
IC27	IT360
IC28-29	IT391
IC30	IT400
IC31	IT364
IC32-33	IT401
IC34-36	IT361
IC37	IT383
IC38-41	IM388
IC54-55	IC355
IC64-71	IM388
IC73-80	IM388
IC82-89	IM388
IC91	IT364
IC92-99	IM388

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EMAX II PARTS LIST

CPU RESISTORS	E-MU P/N	QUANTITY
330Ω x 8 Resistor Net. DIP	RN320	1
220/330Ω x 8 Resistor Net. SIP	RN322	3
22KΩ x 9 Resistor Net. SIP	RN323	1
1KΩ x 9 Resistor Net. SIP	RN327	1
33Ω x 8 Resistor Net. DIP	RN343	1
150Ω Resistor 1/4 W	RR102	3
270KΩ Resistor 1/4 W	RR128	1
100Ω Resistor 1/4 W	RR301	5
330Ω Resistor 1/4 W	RR303	4
1KΩ Resistor 1/4 W	RR305	6
10KΩ Resistor 1/4 W	RR309	3
15KΩ Resistor 1/4 W	RR311	2
22KΩ Resistor 1/4 W	RR313	2
30KΩ Resistor 1/4 W	RR315	1
33KΩ Resistor 1/4 W	RR316	1
680Ω Resistor 1/4 W	RR343	1
270Ω Resistor 1/4 W	RR347	1
1.5KΩ Resistor 1/4 W	RR348	1
7.5KΩ Resistor 1/4 W	RR351	1
3.9KΩ Resistor 1/4 W	RR355	1
10Ω Resistor 1/4 W	RR364	2
75Ω Resistor 1/4 W	RR370	1

RES. LOCATION →	E-MU P/N
RN1-3	RN322
RN4	RN323
RN5	RN320
RN6	RN343
RN7	RN327
R1	RR301
R2-3	RR305
R4	RR313
R5	RR305
R6	RR343
R7	RR305
R8	RR364
R9-10	RR102
R11	RR347
R12	RR128
R13	RR370
R14	RR102
R15	RR309
R16	RR316
R17	RR309
R18	RR305

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EMAX II PARTS LIST

CPU RESISTOR LOCATIONS (cont)

R19	RR364
R20-21	RR303
R22	RR315
R23	RR311
R24	RR351
R25	RR355
R26	RR348
R27	RR311
R29	RR309
R31-32	RR303
R33	RR305
R34-36	RR301
R37	RR313
R38	RR301

CPU CONNECTORS	E-MU P/N	QUANTITY
1/4" Phone Jack	JA301	5
18-pin LP DIP Socket	JC105	36
20-pin LP DIP Socket	JC106	21
24-pin LP DIP Socket	JC107	1
28-pin LP DIP Socket	JC308	2
40-pin LP DIP Socket	JC309	2
16-pin LP DIP Socket	JC311	1
68-pin PLCC Socket	JC326	2
5-pin DIN Connector PC Mount	JI 302	2
36-pin I/O Socket PC Mount	JI 304	2
9-pin DSUB Plug (RS-422)	JI 309	1
Power Header CN-9	JP330	1
Power Header CN-5	JP331	1
Ribbon Cable Header (CN-1)	JR307	1
Ribbon Cable Header (CN-4, CN-6)	JR308	2
40-pin Dual Header (CN-8, CN-11)	JR312	2
50-pin Dual Header (CN-2)	JR327	1

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EMAX II PARTS LIST

KYBD FRONT PANEL

PART	E-MU P/N	QUANTITY
CPU → Frnt. Pnl. Ribbon Cable	AF124	1
2-pin LED Socket	JC321	10
3-pin LCD Socket	JC324	1
7-pin Socket	JC325	2
14-pin 2-row LCD Header	JC327	1
1-pin LCD Header	JC328	2
Jumbo Red LED	LP302	9
Jumbo Green LED	LP308	1
16 x 2 Line Backlit LCD	LP310	1
10KΩ Slide Pot	RC312	2
Rubber Keypad Set	ZR336	1

RACK FRONT PANEL

PART	E-MU P/N	QUANTITY
CPU → Frnt. Pnl. Ribbon Cable	AF134	1
10µF 25V Capacitor Alum.	CA325	2
1N914 Signal Diode	DD301	7
4-40 Kepf Nut	HN304	2
3/8" 4-40 Screw	HS 302	2
+5V → -5V Converter	IL332	1
LCD Mounting Header (Left)	JC327	1
LCD Mounting Header (Right)	JC328	2
Jumbo Red LED	LP302	9
Jumbo Green LED	LP308	1
16 x 2 Line Backlit LCD	LP310	1
10KΩ Slide Pot	RC312	2
25KΩ Trim Pot	RT307	1
Momentary SPST Switch, Grey	SW310	30
Inductor 470Ω at 100MHz	ZI305	1

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EMAX II PARTS LIST

EMAX II OUTPUT BOARD

CAPACITORS	E-MU P/N	QUANTITY
10µF 25V Aluminum Radial	CA325	17
47µF 16V Aluminum	CA326	1
220pF Ceramic	CC104	8
10pF 50V Ceramic	CC301	6
.01µF 50V Ceramic	CC311	18
.1µF 50V Ceramic Radial	CC314	22
3.3pF 50V Ceramic	CC331	2
1000pF 50V Poly Axial	CP107	3
1µF 25V Tantalum	CT315	8

CAP LOCATION →	E-MU P/N
C1	CA325
C2	CC311
C3	CC104
C4-5	CC311
C6	CC104
C7	CC311
C8-10	CA325
C11-12	CC314
C13-15	CA325
C16	CC311
C17	CC104
C18-19	CC311
C20	CC104
C21	CC311
C22	CC314
C23	CA326
C24-26	CC314
C27-28	CT315
C29	CC314
C30	CA325
C31-33	CC314
C34	CC311
C35	CC104
C36-37	CC311
C38	CC104
C39-40	CC311
C41-44	CT315
C45	CC314
C46	CC315
C47	CA325
C48	CT315

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EMAX II PARTS LIST

OUTPUT CAP LOCATIONS (cont)

C49-51 ---------- CC314
C52 ---------- CA325
C53 ---------- CC311
C54 ---------- CC314
C56-57 ---------- CA325
C58 ---------- CC331
C59 ---------- CC301
C60 ---------- CC311
C61 ---------- CC104
C62-63 ---------- CC311
C64 ---------- CC104
C65 ---------- CC311
C66-68 ---------- CC314
C71 ---------- CC331
C72 ---------- CC301
C73-74 ---------- CC314
C75-76 ---------- CA325
C77-80 ---------- CC301
C81-83 ---------- CA325
C84-85 ---------- CC314

OUTPUT BOARD IC's

ICs	E-MU P/N	QUANTITY
8-bit MDAC	II 331	1 or 2
CSZ5126 16-bit ADC (mono)	II 359	1
CSZ5326 16-bit ΔΣ ADC (stereo)	II 361	1
18-bit Serial DAC	II 360	8
-5V 1A Voltage Regulator	IL112	1
+5V 1A Voltage Regulator	IL307	1
5532 Dual OpAmp	IL326	9
8212 Prog. Voltage Reference	IL334	1
74HCT244 Octal Buffer	IT360	1

IC LOCATION → E-MU P/N

IC1 ---------- II 360
IC3 ---------- IL326
IC4-5 ---------- II 360
IC6 ---------- IL326
IC7-8 ---------- II 360
IC9 ---------- II 359
IC11 ---------- IL326
IC12 ---------- II 360

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EMAX II PARTS LIST

OUTPUT BOARD IC LOCATIONS (cont)

IC14 ---------- II 360
IC15 ---------- IL326
IC16 ---------- II 331
IC17-20 ---------- IL326
IC21 ---------- II 360
IC22 ---------- IT360
IC23 ---------- IL326
IC24 ---------- IL334
VR2 ---------- IL112
VR1 ---------- IL307

CONNECTORS	E-MU P/N	QUANTITY
1/4" Phone Jack, Closed Ring	JA309	11
28-pin DIP Socket LP	JC308	2
16-pin DIP Socket LP	JC311	9
40-pin Dual Row Header	JR312	1

RESISTORS	E-MU P/N	QUANTITY
10KΩ x 8 Resistor Net. DIP	RN302	1
10KΩ x 9 Resistor Net. SIP	RN324	1
10KΩ Precision Resistor	RP106	8
7.5KΩ Precision Resistor	RP351	1
6.98KΩ Precision Resistor	RP370	10
11.5KΩ Precision Resistor	RP371	2
10.2KΩ Precision Resistor	RP372	1
100KΩ Precision Resistor	RP373	4
5.62KΩ Precision Resistor	RP374	8
1.54KΩ Precision Resistor	RP375	8
470Ω Resistor	RR106	2
620Ω Resistor	RR107	8
100Ω Resistor	RR301	3
4.7KΩ Resistor	RR307	2
10KΩ Resistor	RR309	12
100KΩ Resistor	RR318	3
9.1KΩ Resistor	RR321	1
3.0KΩ Resistor	RR327	1
51Ω Resistor	RR361	4
10Ω Resistor	RR364	4

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EMAX II PARTS LIST

RESISTOR LOCATION →	E-MU P/N
RN1	RN302
RN2	RN324
R1	RP370
R2	RP374
R4-5	RP375
R7	RP374
R8	RP370
R9-10	RR309
R11	RR364
R12	RP370
R13	RP374
R15-16	RP375
R18	RP374
R19	RP370
R20	RR301
R22	RR361
R23	RP370
R24	RP374
R26-27	RP375
R29	RP374
R30	RP370
R31	RR364
R32-33	RR361
R34	RP373
R35	RP372
R36	RP106
R37	RP370
R38	RP374
R40-41	RP375
R43	RP374
R44	RP370
R45	RR361
R46-47	RP373
R48	RP351
R49	RP106
R50	RP370
R51	RP106
R52	RP370
R53-54	RP371
R55	RP106
R56	RP373
R57	RR309
R58	RR107
R59	RR309
R60-61	RR107

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EMAX II PARTS LIST

OUTPUT RESISTOR LOCATIONS (cont)

R62 ---------- RR309
R63-64 ---------- RR107
R65 ---------- RR309
R66 ---------- RR107
R67 ---------- RR307
R68 ---------- RR309
R69 ---------- RR107
R70 ---------- RR307
R71 ---------- RR309
R72 ---------- RR107
R73-74 ---------- RP106
R75-76 ---------- RR309
R77 ---------- RR301
R78 ---------- RR309
R79 ---------- RR301
R80 ---------- RR309
R81 ---------- RR318
R82 ---------- RR321
R83 ---------- RR327
R84-85 ---------- RR364
R86-87 ---------- RP106
R88-89 ---------- RR318
R90-91 ---------- RR106

MISC. PARTS	E-MU P/N	QUANTITY
1N914 Signal Diode	DD301	3
4-40 Kepf Nut	HN304	2
3/8" 4-40 Screw	HS302	2
Output Switching Relay 5VDC	SK120	1
2N4121 Transistor	QQ101	1
Black Anodized TO-220 Heatsink	ZE324	2
470Ω @ 100MHz Inductor	ZI305	2
Front Panel Label (KYBD)	ZL398	1
Front Panel Label (Rack)	ZL399	1
Switching Power Supply	ZV308	1

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EMAX II PARTS LIST

EMAX II MEMORY EXPANSION BOARD (AH 124)

PART	E-MU P/N	QUANTITY
.1µF 20% 50V Axial Capacitor	CC363	57
44256 256K x 4 DRAM	IM387	16, 32, or 48
PAL GMXCTL	IP430	1
PAL GMX1MRC	IP436	1
PAL GMX1MRA	IP437	1
PAL GMX1MRI	IP438	1
74S244 Octal Buffer	IT332	3
74HCT245 Octal Tristate Buffer	IT383	2
20 pin LP DIP Socket	JC106	32
36 pin PC Mount I/O Plug	JI303	2
4.7KΩ 5% 1/4 W. Resistor	RR357	2
10Ω 5% 1/4 W. Resistor	RR364	4

OTHER MISC. PARTS

PART	E-MU P/N	QUANTITY
Emax II Operation Manual	FI368	1
Emax II Service Manual	FI375	1
US Power Cord	AB126	1
Western Europe Power Cord	WC308	1
10' MIDI Cable	WC309	1
Shipping Box (KYBD)	ZS363	1
Shipping Box (KYBD Top Tray)	ZS368	1
Shipping Box (KYBD Bottom Tray)	ZS369	1
Shipping Box (Rack)	ZS358	1
Shipping Box (Rack Foam Insert)	ZS360	1

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RECOMMENDED SPARE PARTS
FOR SERVICE CENTERS

Part No.	Description	Cost	Retail
Assemblies			
AF105	Front Panel PCB (KYBD)	$ 162.00	$ 243.00
AF133	Front Panel PCB (Rack)	$ 225.00	$ 338.00
AF105	Keyboard Front Panel PCB	$ 162.00	$ 243.00
AF133	Rack Front Panel PCB	$ 225.00	$ 338.00
AH100	1 MB Non-Turbo CPU PCB	$ 1185.00	$ 1780.00
AH101	Analog PCB	$ 375.00	$ 560.00
AH103	Memory Expansion PCB	$ 750.00	$ 1125.00
AH107	2 MB Turbo CPU PCB	$ 1270.00	$ 1905.00
AH127	Stereo Analog PCB	$ 460.00	$ 690.00
ZK308	5-octave Keyboard	$ 186.50	$ 280.00
ZM329	3.5" Floppy Disk Drive	$ 130.00	$ 195.00
ZM341	40 Mb Hard Disk Drive	$ 595.00	$ 895.00
ZV308	Power Supply	$ 89.00	$ 133.50
Housing Components			
EM339	Metal Bottom Panel (Kybd)	$ 60.70	$ 91.00
EM340	Keyboard Mounting Bracket	$ 10.40	$ 15.60
EM365	Hard Drive Mounting Plate	$ 9.75	$ 14.60
EM411	Rack Chassis, Lower	$ 60.00	$ 90.00
EM412	Rack Chassis, Upper	$ 110.00	$ 165.00
EM415	Rack Chassis, Panel	$ 42.75	$ 64.00
EM416	Rack Mounting Ears	$ 13.50	$ 20.25
EP365	Plastic Housing (Kybd)	$ 226.75	$ 340.00
HK323	Slider Knob	$ .30	$ .45
SW309	DPST Power Switch (Kybd)	$ 4.90	$ 7.40
SW310	SPST Grey Switch (Rack)	$ 1.65	$ 2.50
SW311	DPST Power Switch (Rack)	$ 10.00	$ 15.00
Cables			
AF116	Keyboard to CPU	$ 4.95	$ 7.50
AF124	CPU to Front Panel (Kybd)	$ 9.60	$ 14.40
AF134	CPU to Front Panel (Rack)	$ 11.85	$ 17.80
AH106	CPU to Analog	$ 6.75	$ 10.00
AH114	Power Supply to CPU	$ 25.50	$ 38.25
AH115	CPU to Floppy Disk	$ 6.30	$ 9.45
AH121	CPU to Hard Disk (Kybd)	$ 12.45	$ 18.70
AH122	CPU to Hard Disk (Rack)	$ 15.00	$ 22.50
PCB Components			
IC129	4028 CMOS Decoder	$ .57	$ .85
IC208	4051 CMOS Analog Mux.	$ .69	$ 1.04
IC355	74HCT299 CMOS 8-bit Shift Reg.	$ 1.17	$ 1.76
II341	WD1772 Floppy Controller	$ 20.00	$ 30.00
II348	9437A Dual Differential Recvr.	$ 2.40	$ 3.60

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RECOMMENDED SPARE PARTS

Part No.	Description	Cost	Retail
PCB Components (cont)			
II349	5380 SCSI Controller	$ 17.70	$ 26.55
IM341	8254-2 Interval Timer	$ 12.18	$ 18.27
IM368	6500/11 Microcomputer	$ 22.23	$ 33.34
IM372	6850 UART	$ 3.54	$ 5.31
IM376	EEPROM	$ 3.60	$ 5.40
IM386	32CG16-10 CPU	$ 37.50	$ 56.25
IM387	44256 256K X 4 DRAM	$ 32.25	$ 48.58
IM388	4464 64Kx4 DRAM	$ 12.00	$ 18.00
IP434	EPROM LS Boot	$ 24.95	$ 29.95
IP435	EPROM MS Boot	$ 24.95	$ 29.95
IT357	74HCT138 3-8 Decoder	$ .45	$ .68
IT360	74HCT244 Octal Buffer	$ .69	$ 1.04
IT361	74HCT273 Octal Flip Flop	$ .75	$ 1.13
IT364	74HCT393 Dual 4-bit Counter	$ 1.11	$ 1.67
IT375	74S04 Hex Inverter	$ .36	$ .54
IT383	74HCT245 Octal Tri-State Buffer	$ .75	$ 1.13
IT391	74HCT373 Octal Latch	$ .54	$ .81
IT398	74HCT14 Hex Inverter	$ .57	$ .85
IT400	UA9638 Dual Line Driver	$ 1.65	$ 2.48
IT401	74S158 2-Input Quad Mux	$ .96	$ 1.44
JA301	1/4" Phone Jack	$ 1.29	$ 1.94
JI302	5-pin DIN Connector	$ 2.46	$ 3.69
JI304	36-pin I/O Socket	$ 6.00	$ 9.00
JI309	9-pin D-SUB Plug (RS422)	$ 4.26	$ 6.39
LP302	Red LED	$ .30	$ .45
LP308	Green LED	$ .90	$ 1.35
LP310	16x2 Line Backlit LCD	$ 82.50	$ 123.90
OE302	PC900 Iso-Optolator	$ 2.10	$ 3.50
Accessories			
AF240	External SCSI Cable	$ 24.95	$ 37.50
FI368	Owners Manual	$ 25.00	$ 25.00
FI375	Service Manual	$ 75.00	$ 75.00
WC309	10' MIDI Cable	$ 6.65	$ 9.95
WC314	Stereo Cable Adapter	$ 6.00	$ 9.00
ZS358	Shipping Box (Rack)	$ 6.00	$ n/a
ZS360	Shipping Foam (Rack)	$ 21.60	$ n/a
ZS363	Shipping Box (Kybd)	$ 11.60	$ n/a
ZS368	Shipping Tray, Top (Kybd)	$ 7.00	$ n/a
ZS369	Shipping Tray, Bottom (Kybd)	$ 14.00	$ n/a

- Prices Subject to Change Without Notice -

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EMAX II WARRANTY POLICY

E-mu Systems, Inc.
EMAX II AUTHORIZED SERVICE CENTER POLICIES

January, 1990

This service program covers E-mu Systems, Inc. *Emax II*. It is highly recommended that Service Centers have adequate supplies of spare parts on hand to efficiently represent E-mu Systems. It is necessary for Service Centers to have adequate test equipment and comply with the E-mu Systems Electro Static Discharge (ESD) specification. Service Centers should conduct business in a professional manner and provide E-mu with information concerning product quality and customer requirements.

EMAX II PRODUCT WARRANTY

E-mu Systems warranty covers all defects in materials and workmanship for a period of ONE YEAR from the date of purchase by the original owner. The warranty does not cover:

1. Damages due to improper or inadequate maintenance, accident, misuse, abuse, alteration, unauthorized repairs, tampering, or failure to follow normal operating procedures as outlined in the user's manual.
2. Damage or deterioration of cabinet.
3. Damages occurring during any shipment of the product for any reason.
4. Any product that has been modified in any way by anyone other than E-mu Systems, Inc. or E-mu Authorized Service Centers.

SERVICE CENTER

E-mu Authorized Service Centers will provide for warranty and non-warranty repair of Emax II equipment. Service Centers will perform required updates, repair PCB's, and exchange failed parts.

WARRANTY PARTS

Warranty parts are those belonging to a warranty Emax II System and those parts held as warranty inventory by a Service Center. E-mu will replace any faulty warranty parts or components due to defective workmanship or materials.

WARRANTY PARTS RETURN

Warranty parts to be returned will require a Return Authorization. Please call E-mu Service Department for authorization and write the number on the outside of the package. Service Centers are responsible for all freight charges incurred when returning parts to E-mu Systems, Inc.

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WARRANTY SWAP

Provided the Service Center has adequate credit terms with E-mu, a replacement part will be billed and sent freight prepaid before the failed part is returned. A Return Authorization number will be assigned to the replacement part and should be used when returning the failed part. The Return Authorization number should be written on the outside of the return package. Failed parts will be credited to the Service Center account provided they are received at E-mu within sixty days (ninety days for international) of initial Warranty Swap.

WARRANTY CLAIM FORM

E-mu will reimburse Service/Warranty Centers for warranty work performed on Emax II equipment. In order to be eligible for reimbursement, please submit a completed Warranty Claim Form, a copy of Customer Proof of Purchase, and return within SIXTY days of repair date. Please provide adequate information of failure symptom and the repair performed. All other information must be complete.

Parts used for warranty repair should be listed on the Warranty Claim Form and returned for credit. Please return the replaced parts with the Warranty Claim Form stating the failure.

ECO'S

E-mu will provide Service Centers with ECO's recommended to improve the performance of Emax II. Warranty reimbursement will only be provided for those ECO's required by E-mu Systems Service Department.

CREDIT TERMS

Credit terms are required to receive Warranty Swaps on account. If you do not have an account with E-mu Systems, please contact the E-mu Service Department for a credit application.

FACTORY AUTHORIZATION

If any questions or problems arise regarding Warranty Repair or Warranty Swap, please call for authorization before working on Emax II.

TECHNICAL SUPPORT

E-mu Systems provides Service Centers with telephone support lines to assistance in resolving technical questions. U.S. telephone support hours are between 9:00 am and 5:00 pm PST Monday through Friday. E-mu Service Department (408) 438-1921. European technical support can be obtained through Ruud Van Der Matten at 31-78-312346.

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FACTORY REPAIRS

If the Service Center is unable to resolve the failure, please notify E-mu Service and request a Return Authorization.

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E-MU SYSTEMS PRODUCT WARRANTY

Please read this warranty, as it gives you specific legal rights.

Length of Warranty

This warranty covers all defects in materials and workmanship for a period of one year from the date of purchase by the original owner, provided that the Warranty Registration Card is filled out and returned to E-mu Systems within 14 days from the date of purchase. Cases may arise where E-mu's Service Department or one of E-mu's authorized service centers will ask for a copy of your sales receipt to facilitate warranty service. Please keep your purchase receipt in a safe place.

E-mu Systems does not cover:

- Damages due to improper or inadequate maintenance, accident, abuse, misuse, alteration, unauthorized repairs, tampering, or failure to follow normal operating procedures as outlined in the owner's manual.
- Deterioration or damage of the cabinet.
- Damages occurring during any shipment of the product for any reason.
- An E-mu product that has in any way been modified by anyone other than E-mu Systems, Inc.

Limitation of Implied Warranties

No warranty is expressed or implied. E-mu Systems specifically disclaims the implied warranties of merchantibility and fitness for a particular purpose.

Exclusion of Certain Damages

E-mu Systems' liability for a product found defective is limited to repair or replacement of the unit, at E-mu's option. In no event shall E-mu Systems be liable for damages based on inconvenience, whether incidental or consequential, loss of use of the unit, loss of time, interupted operation or commercial loss, or any other consequential damages. *Some states do not allow limitation of the duration of implied warranties or the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.*

How To Obtain Warranty Service

All E-mu products are manufactured with the highest standards of quality. If you find that your instrument does require service, it may be done by an authorized E-mu service center. If you are unable to locate a service center in your area, please contact E-mu Systems Service Department at (408) 438-1921. They will either refer you to an authorized service center or ask that you return your instrument to the factory. When returning an instrument to the factory, you will be issued a Return Merchandise Authorization number (RMA). Please label all cartons, shipping documents and correspondance with this number. E-mu suggests you carefully and securely pack your instrument for return to the factory. Mark the outside of the shipping carton clearly with your RMA number. Send to E-mu Systems, Inc. 1600 Green Hills Road, Scotts Valley, California, 95066. You must pre-pay shipping charges to the service location. E-mu Systems will pay return shipping fees. You will be responsible for any damage or loss sustained during shipment in any direction.

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ECO's and UPDATES

EMAX II

MEMORY *EXPANSION*

Retrofit Instructions

As shown in the charts below, a standard Emax II, with initial RAM of 1 Mbyte, can be upgraded to a maximum of 7 Mbytes. An Emax II, with initial RAM of 4 Mbtye, can be increased to a maximum of 8 Mbytes of memory. Upgrades are added in 2 Mbyte increments. With this in mind, you first need to determine the amount of memory currently in the unit. To do this, first *Erase All Memory* (Master, 4), then check *Memory Remaining* (Master, 2). The remaining memory will be displayed in 16-bit *SAMPLES*, not bytes, so double the number to find the amount of memory in bytes.

1 Mb Emax II

		Total Memory
1st add	2207 Memory Board	3 Mb
2nd add	2208 2 Mb Expander	5 Mb
3rd add	2208 2 Mb Expander	7 Mb

4 Mb Emax II

		Total Memory
1st add	2208 2 Mb Expander	6 Mb
2nd add	2208 2 Mb Expander	8 Mb

Kit 2207 **Memory Board** (1 Megabyte to 3 Megabytes)

(1) 2 Mb memory expander board (E-mu PN AH124)
(4) 6-32 x 1/4" screws (E-mu PN HS339)

Kit 2208 **2 Mb Memory Expansion** (All other memory upgrades)

(16) 44256 256K x 4 DRAMs (E-mu PN IM387)
(1) Programmed PAL (E-mu PN IP439)
(1) Programmed PAL (E-mu PN IP440) > Note: Some memory updates do not require a PAL change.
(1) Memory Expansion (Install) Diskette (E-mu PN ZD862)
(Note: the Install disk can only be used once.)

Tools needed: Phillips Screwdriver, Wire Cutter, IC Remover, Needle Nose Pliers

Before doing *anything*, make sure the Emax II is fully functional!

■ ***MEMORY TEST***
Run a Bank and G-RAM memory test on the unit (**Master, 99** *Secret Code* = 3629 = Emax spelled on a telephone dial).

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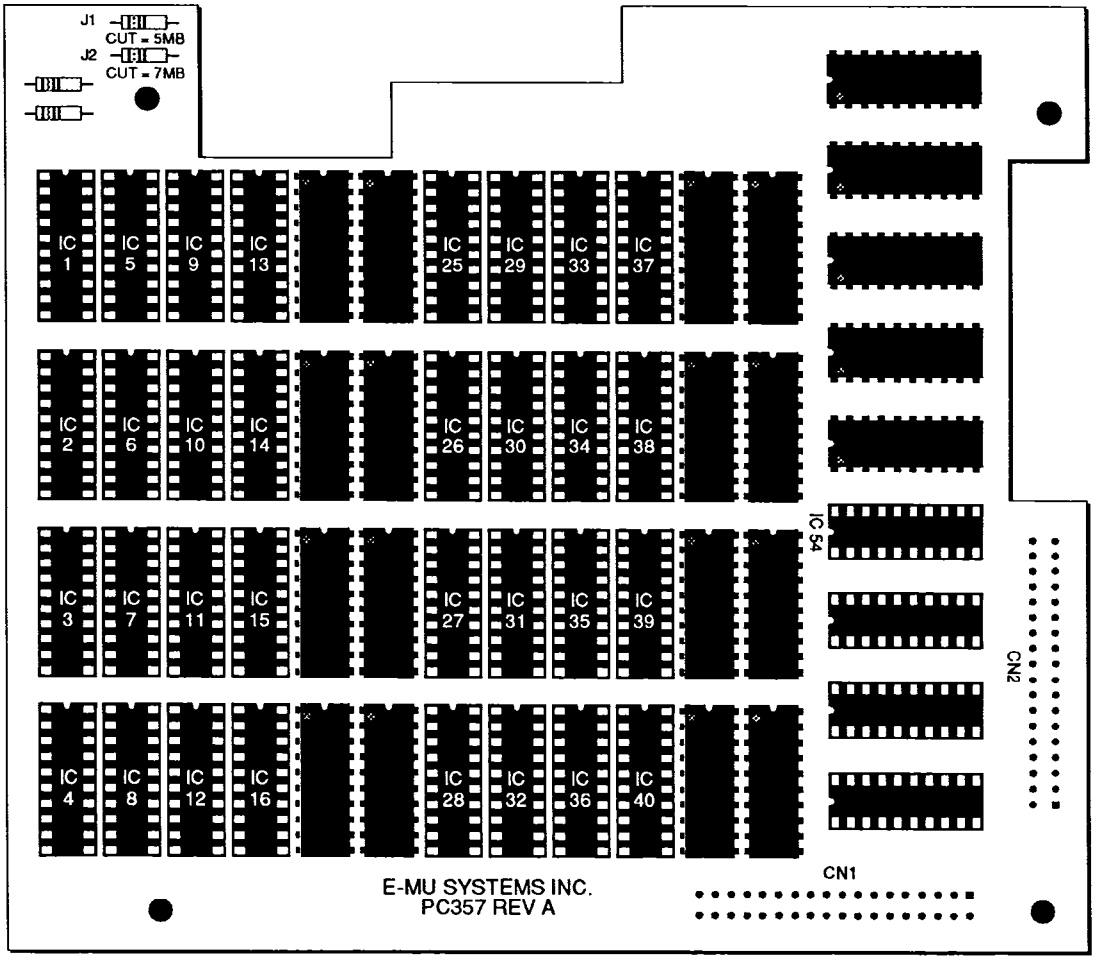
■ Disassembly

1) Disconnect AC, then place the Emax II upside down on a padded surface. Next, remove the (10) bottom panel screws from the perimeter of the bottom panel. Put the screws aside in a safe place.

2) Remove the bottom panel. Be especially careful on rack units not to stress the ribbon cables as you unplug them.

The five possible memory updates will be described.

- 1 Megabyte ➡ 3 Megabyte Update
- 3 Megabyte ➡ 5 Megabyte Update
- 5 Megabyte ➡ 7 Megabyte Update
- 4 Megabyte ➡ 6 Megabyte Update
- 6 Megabyte ➡ 8 Megabyte Update



Emax II Memory Expansion Board

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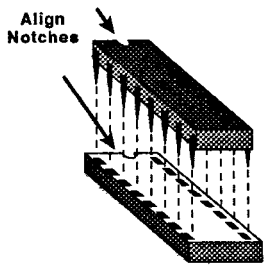
A FEW WORDS ABOUT *STATIC*

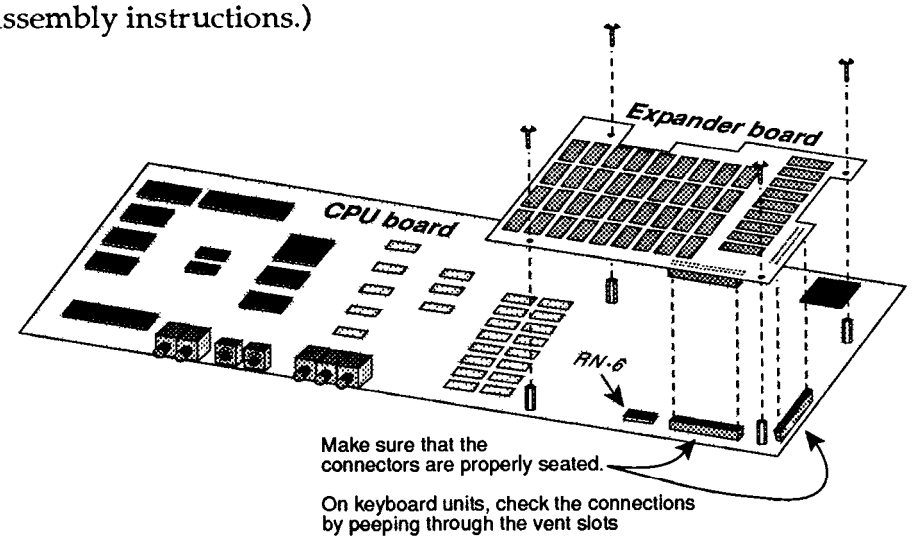
Static discharge from from your body has the potential to damage the memory update chips. Before touching any ICs or the memory expansion board, ground yourself by touching the inside of the Emax II enclosure. Do this frequently, especially after moving around, in order to keep your body discharged and the electronic components safe.

■ 1 MEGABYTE ➠ 3 MEGABYTE UPDATE (Kit 2207)

1) Locate resistor pack RN-6 on the rear of the CPU circuit board and remove it.
2) Install the Memory Upgrade board to the CPU board. Make sure that connectors CN1 and CN2 are ***firmly*** seated, (there will be an audible click with proper installation) then screw down the board to the standoffs with the (4) screws provided.
3) Boot up machine and test the memory again using the special diagnostics. If not OK, check the connectors.
4) Check *Memory Remaining* (Master, 2). Display should show new amount (1,572,820).
5) Reassemble unit. (See reassembly instructions.)



When inserting an IC into a socket, make sure that the pins are straight and the notches are aligned.



■ 3 MEGABYTE ➠ 5 MEGABYTE UPDATE (Kit 2208)

1) Remove IC54 from the memory expansion board. Replace it with IP439. Take care not to bend any of the IC pins and make sure that the chip is properly aligned.
2) Install memory chips 9-16 and 33-40 into the memory expansion board. Again, be sure that no pins are bent under and that all the chips are correctly aligned.
3) Clip out resistor J-1 from expansion board.
4) Boot up machine and run a G-RAM memory test (pg. 1). The display should say, "PASSED".
5) Insert the "Install" disk. Select **Master, Special, 8 - Install Disk**. Display says, "Installing".
6) Power down unit and re-boot. Test memory again.
7) Check *Memory Remaining* (Master, 2). Display should show new amount (2,621,396).
8) Reassemble unit. (See reassembly instructions.)

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■ 4 MEGABYTE ➠ 6 MEGABYTE UPDATE (Kit 2208)

1) Install memory chips 9-16 and 33-40 into the memory expansion board. Be sure that no pins are bent under and that all the chips are correctly aligned.
2) Boot up machine and run a G-RAM memory test (pg. 1). The display should say, "PASSED".
3) Insert the "Install" disk. Select **Master, Special, 8 - Install Disk**. Display says, "Installing".
4) Power down unit and re-boot. Test memory again.
5) Check *Memory Remaining* (Master, 2). Display should show new amount (3,145,684).
6) Reassemble unit. (See reassembly instructions.)

■ 5 MEGABYTE ➠ 7 MEGABYTE UPDATE (Kit 2208)

1) Remove IC54 from the memory expansion board. Replace it with IP440. Take care not to bend any of the IC pins and make sure that the chip is properly aligned.
2) Install memory chips 1-8 and 25-32 into the memory expansion board. Again, make sure that no IC pins are bent under and that all the chips are correctly aligned.
3) Clip out resistor J-2 from expansion board.
4) Boot up machine and run a G-RAM memory test (pg. 1). The display should say, "PASSED".
5) Insert the "Install" disk. Select **Master, Special, 8 - Install Disk**. Display says, "Installing".
6) Power down unit and re-boot. Test memory again.
7) Check *Memory Remaining* (Master, 2). Display should show new amount (3,669,972).
8) Reassemble unit. (See reassembly instructions.)

■ 6 MEGABYTE ➠ 8 MEGABYTE UPDATE (Kit 2208)

1) Install memory chips 1-8 and 25-32 into the memory expansion board. Be sure that no pins are bent under and that all the chips are correctly aligned.
2) Boot up machine and run a G-RAM memory test (pg. 1). The display should say, "PASSED".
3) Insert the "Install" disk. Select **Master, Special, 8 - Install Disk**. Display says, "Installing".
4) Power down unit and re-boot. Test memory again.
5) Check *Memory Remaining* (Master, 2). Display should show new amount (4,194,260).
6) Reassemble unit. (See reassembly instructions.)

■ Reassembly

1) On rack units, reconnect the output board cable and make sure that it is plugged in correctly or serious damage may occur.
2) Replace the bottom panel and the (10) bottom panel screws around the perimeter.
3) Give the unit a complete functional test, including a full length sample test.

Note: If the output board ribbon cable isn't plugged in, the Transpose LED will remain lit when the unit is powered on.

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EMAX II

STE*REO* SAMPLING

Retrofit Instructions

This kit upgrades an Emax II with true phase-linear stereo sampling capability. The retrofit is designed to be performed by an E-mu dealer or service center. Removing and installing an IC chip is the only skill needed to perform the retrofit.

Tools needed: Phillips Screwdriver,
IC Remover or small flat blade screwdriver (to remove ICs)

Kit 2211 Stereo Sampling Upgrade

Contents:

(1) Retrofit Instructions *(Detach pages 5-7 and give to Emax II owner)*
(1) 5326 Stereo 16-bit ADC (E-mu PN II361)
(1) 7524 Level DAC (E-mu PN II331)
(1) Programmed "GSTEREO" PAL (E-mu PN IP457)
(1) Stereo Y-Cable (E-mu PN WC314)
(1) Stereo Sampling Installation/Operation Software Disk (E-mu PN ZD868)
Note: the Install disk can only be used once.

■ Disassembly

1) Disconnect AC, then place the Emax II upside down on a padded surface. Next, remove the (10) bottom panel screws from the perimeter of the bottom panel. Put the screws aside in a safe place.

2) Remove the bottom panel. Be especially careful on rack units not to stress the ribbon cables as you unplug them.

A FEW WORDS ABOUT *STATIC*

Static discharge from your body has the potential to damage the IC chips in the Emax II. Before touching any ICs or Emax II circuit boards, ground yourself by touching the inside of the Emax II enclosure. Do this frequently, especially after moving around, in order to keep your body discharged and the electronic components safe.

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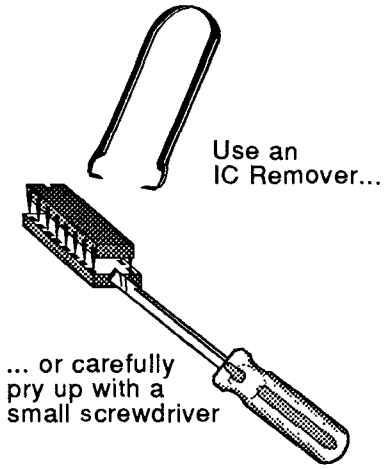
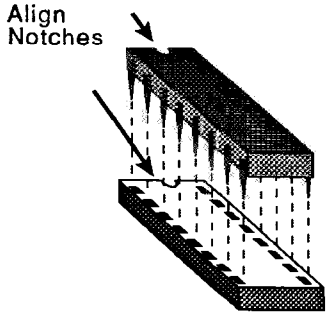
IC Removal



Use care when removing an IC! Pull straight up when using an IC remover or carefully pry up each end of the chip using a small, flat bladed screwdriver.

IC Insertion



When inserting an IC into a socket, straighten the pins and make sure that they are seated in the sockets. The notches on the chip and socket *must be* correctly aligned!

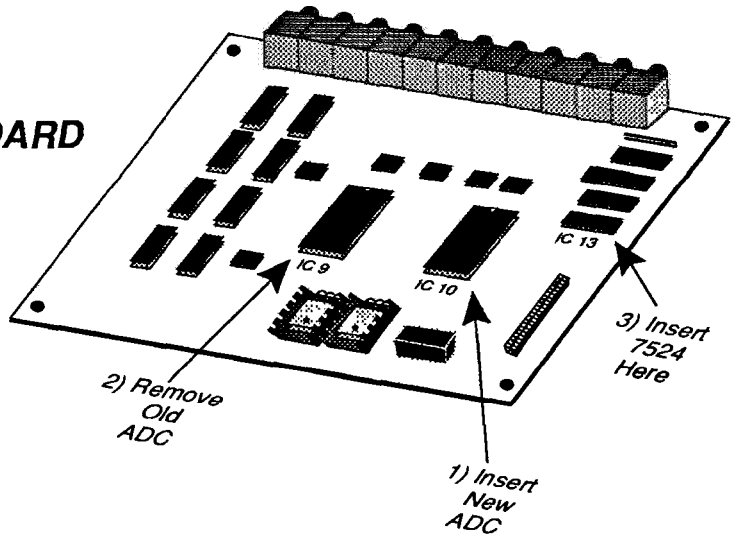
■ STEREO-IZE

Refer to the diagrams and perform the following IC replacements:

1) Insert the new 5326 Stereo ADC into the empty socket at IC 10. Next, remove the old 5126 ADC from the socket in the output board at location IC 9.

2) Insert the 7524 Volume DAC into the empty socket at location IC 13 on the output board.

EMAX II
OUTPUT BOARD



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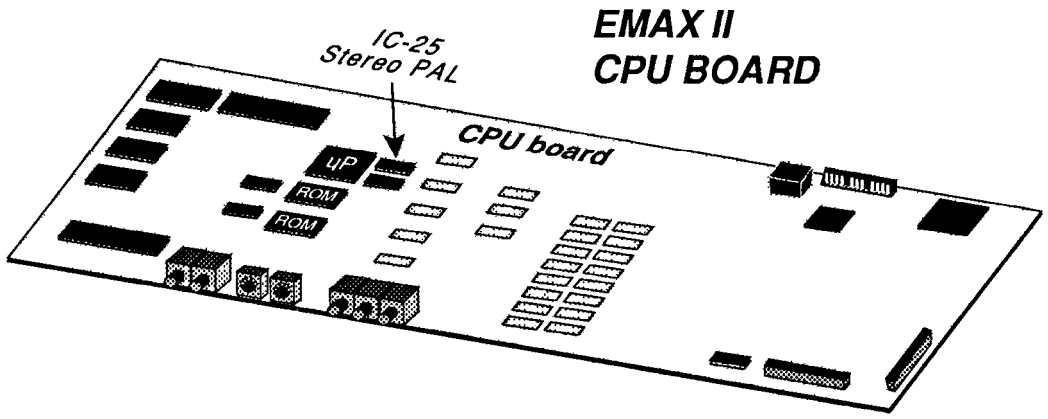
3) Remove the IC at location IC 25 on the CPU board and replace it with the GSTEREO PAL (supplied).



4) Visually check the ICs that you just installed and make sure that all the pins are correctly seated.

■ Reassembly

1) On rack units, re-connect the output board cable (and SCSI cable if present). Make sure that these cables are plugged in correctly or serious damage may occur. It's easy to offset the connectors by one pin, so be careful!

2) Replace the bottom panel and the (10) bottom panel screws around the perimeter.

Note: If the output board ribbon cable isn't plugged in, the Transpose LED will remain lit when the unit is powered on.

■ Software Update

1) Insert the Emax II Software/Install diskette into the drive and power-up the Emax.

2) When the Emax II has finished booting, press MASTER, Special, 8 (Install Disk). The display says,"Installing", and then returns you to the MASTER module. The "Install" disk must be write-enabled (window closed) in order to work. The purpose of the "Install" disk is to inform the Emax II that it is now a *stereo* machine.

WARNING: Using the Stereo Install disk on an Emax II that does NOT have the stereo sampling hardware will permanantly disable proper function of mono sampling (as well as disabling the Stereo Install disk).

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3) Verify the installation by re-booting the machine using the new version 2.00 software. Enter the SAMPLE module. The display shows:

4) Sample a test sound in stereo to verify that the hardware is functional. The stereo VU meter will also provide a good indicator of functionality.

5) Copy the new 2.00 software over to **all** your Emax II disks if you have a non-hard disk unit. This will prevent the annoying, "Different Software Rev." error message from constantly appearing when you change modules. Copy the software to your hard disk if you have one.

PROBLEMS? Open up the unit, re-read the instructions and check your work. Bent IC pins or an IC inserted into the wrong location are common mistakes. If you cannot find the problem, have someone else check your work. If you are still having problems, call E-mu Customer Service at (408) 438-1921 between the hours of 9:00 - 5:00 PST, Monday - Friday.

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